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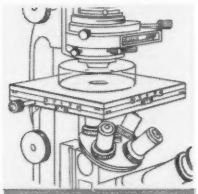

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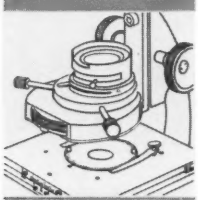

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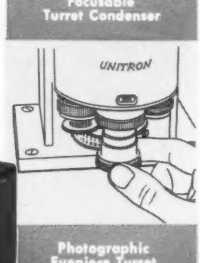

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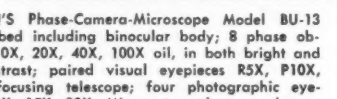

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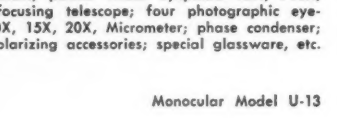

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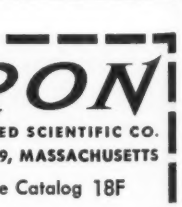

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CONTENTS

American Institute of Biological Sciences —A Progress Report ..... *James G. Dickson* 15

A Biologist Visits Russia ..... *Fred R. Cagle* 16

Biological Overtones of the Thermal Theory of Biochemical Origins ..... *Sidney W. Fox* 20

Science Education—A Threefold Problem ..... *Sidney S. Greenfield* 23

An Analysis of Salary Data of Biologists from the National Register of Scientific and Technical Personnel *Hiden T. Cox and Joan V. Batterton* 26

Biology in Germany Today ..... *A. Glenn Richards* 29

New Journal in Microform ..... *Carlton M. Herman* 31

Xth International Congress of Genetics 33

Across the Editor's Desk 34

From the Societies 38

Education and Manpower 41

Letters to the Editor 42

Biology Library 43

* * *

COVER. Multiple, abnormal sporophores of *Pleurotus osreatus* (Agaricales, Basidiomycete), resulting from excessive humidity. Photo courtesy of W. N. Meadows, station photographer, University of Florida.

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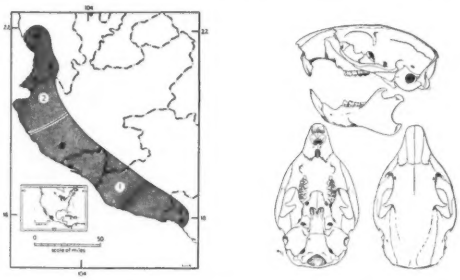

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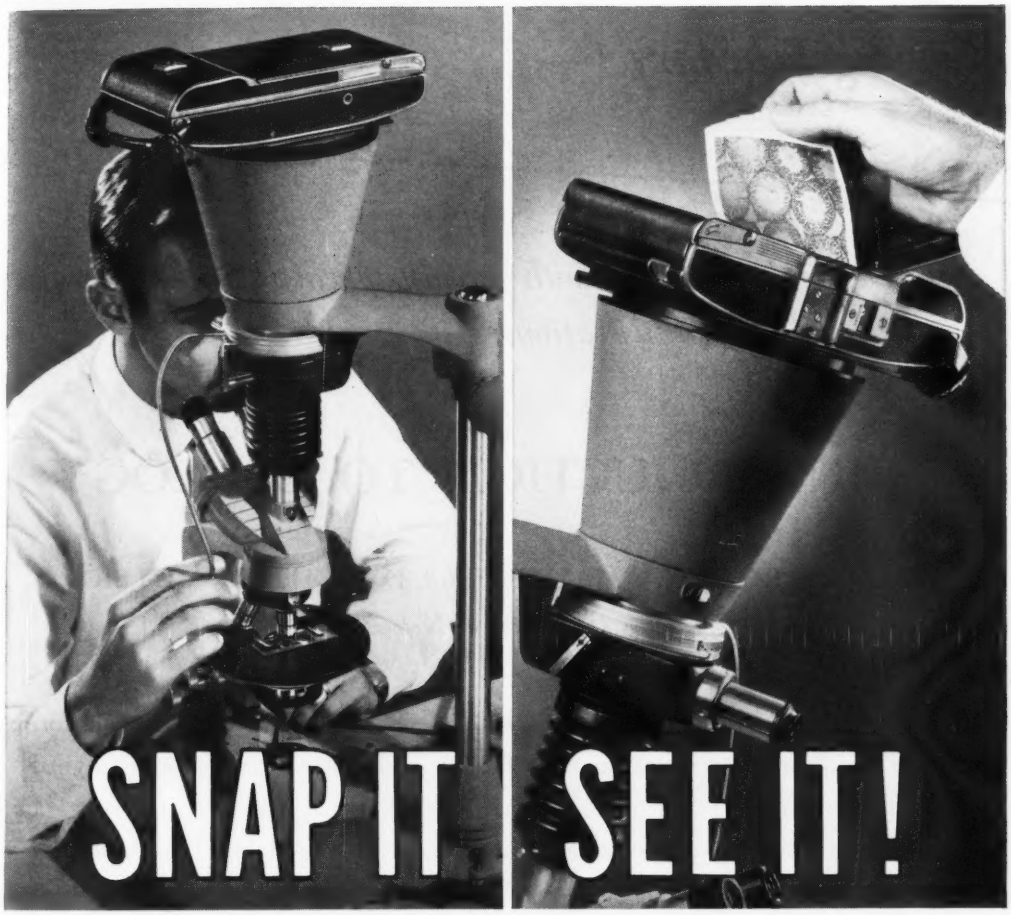

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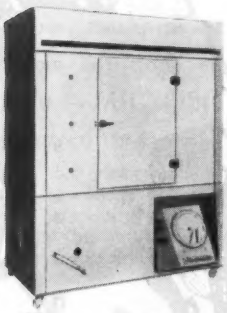

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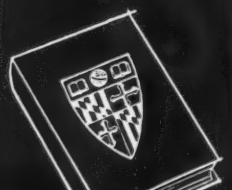

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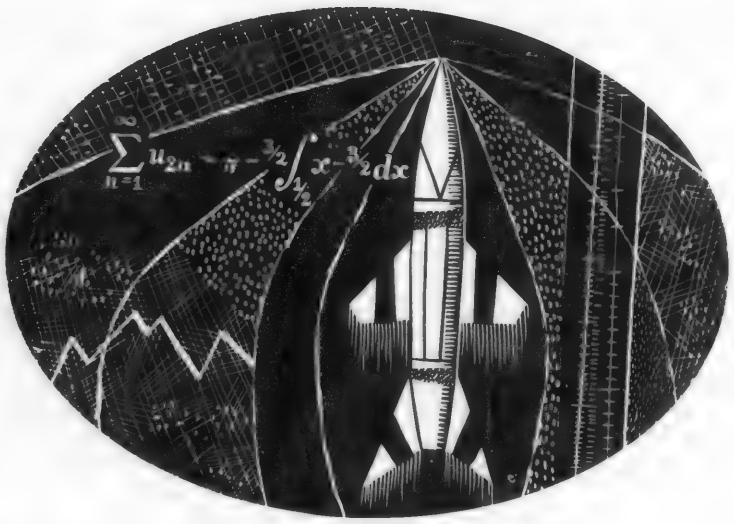

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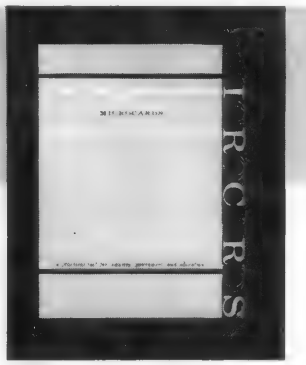

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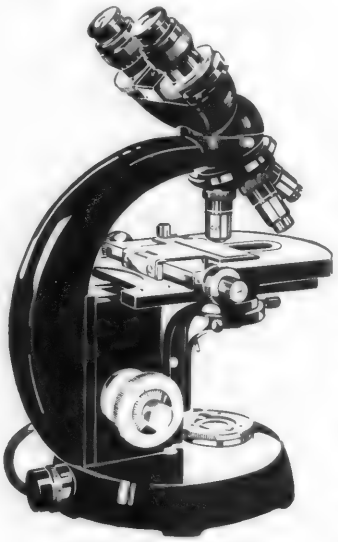

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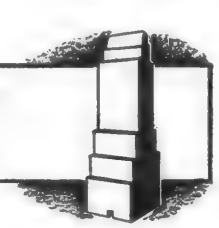

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American Institute of Biological Sciences A Progress Report

JAMES G. DICKSON, *President, AIBS*

DR. FENN, retiring AIBS president, recently defined the objectives of the Institute applicable to both basic and applied research as, "Biology is basic to both medicine and agriculture, and progress in both sciences is dependent upon advances in biological research. Support of this simple but little appreciated thesis is always the most vital objective of AIBS and its chief excuse for existence."

This present progress report points out, perhaps too critically, the failure on the part of some biologists to accept this thesis, lay aside their fears of suppression of honest disagreements, and give united support to AIBS. The biologists must recognize that, "Understanding does not require agreement, but it does require knowledge."

AIBS was founded February 20, 1948. Similar organizations in chemistry, geology, mathematics and physics were demonstrating the effectiveness of this national mode of operation in the development and application of science. In practice biological science had been fragmented into numerous societies. Therefore, the Institute was organized on the basis of society units and was meant in no way to pre-empt the interests of the individual society. Member Societies, through representation on the Governing Board, comprised the directing and coordinating body of AIBS.

An historical résumé of AIBS was presented in the 1951 January and April issues of the *AIBS Bulletin*. A paragraph taken from the letter of Dr. H. B. Steinbach well describes the relation of biology to national welfare. "Great advances in the physical and chemical sciences have led to the disruption of established patterns of life. The sound adjustment of these social patterns can be accomplished only through the fields of research served by the biological sciences. The subjects of the biological sciences, in effect, comprise a study of the ecology of man the animal, as well as the basic attributes of all living things. Upon the foundation of these biological sciences, the new social relationships of man must be adjusted. The responsibility is great."

The responsibility in 1959 is even greater and the wise formulation of educational and research plans more urgent. When the Soviets went into orbit and the Americans slipped into a period of excessive self-condemnation, the Congress responded by appropriating large sums of new monies to accelerate education and expand research in the sciences. These large appropriations placed grave responsibilities and great power in the hands of government agencies.

The wise use of these funds and their equitable distribution in areas of education and research that were in need of support also placed great responsibilities upon the educators and scientists of the nation. Are the biological sciences sufficiently well coordinated and biological knowledge representatively developed to plan for the wise use of these funds? If not, then biology as well as the biologist will reap the penalty and national progress will suffer.

AIBS cannot serve wisely these new demands and other common interests of the biological sciences without the cooperation and support through membership of all biological societies. Member Society representatives on the Governing Board define the problems and determine the policies. Affiliate societies, so to speak, stand on the side lines. Approximately one-third of the societies that deal directly with basic and applied biology are affiliates and as such, they have no direct part in the cooperative resolution of policies and plans by AIBS.

One major objective to be accomplished in 1959 should be broader representation on the Governing Board. As stated earlier, the need for this wide representation is greater now than in any previous period. Progress in the solution of these current problems depends upon the full cooperation of all scientists. Realization of the importance of this united action on the part of the biologist is essential to the development of biology and to national welfare.

Strength expressed through corporate action in some fields of science is well illustrated in national programs and in scientific personnel appointed to the national planning boards and advisory committees. Biology—the science dealing with the development, nutrition and health of plants and animals as well as biology—the basic science determining human behavior, so far have played only a minor role in the national program. Biologists themselves are principally responsible for this unbalanced national situation and minority representation.

A progress report of AIBS is much easier to discuss. For here, dynamic, concrete growth and accomplishments can be listed and elaborated.

During its first ten years, growth and adjustment to better serve the needs of biological societies and biologists have been phenomenal. The progress made is attributed in large part to the dynamic support of the member societies and to the devoted service and creative thought of the member-society representatives on the Governing Board. Much credit is due also to the constructive leadership of the Executive Directors and the efficient, devoted service through long hours of the office staff.

Fortunately, a democratic spirit and honest, cooperative attitude have dominated the deliberations and actions of the Governing Board and Executive Committee. Unfortunately, the members of the Board have had to serve by proxy in the areas of biology not represented by Member Societies. This handicap must be eliminated soon for the responsibilities now placed upon the Institute by government agencies, foundations, and biological societies are too great to proceed wisely without broader representation.

Some of the major accomplishments of AIBS and problems presently before the Board are summarized below, although not necessarily in order of importance.

Finances. This summary does not include the annual treasurer's report (see Nov. 1958 *AIBS Bulletin*). It attempts only to show 1) the sources of income, 2) the cost of basic services to the Societies, 3) the total funds entrusted to the Institute through contracts or assignments for specific studies in the field of biology, and 4) the relative financial growth and immediate financial needs of AIBS.

Initially the costs of services to the membership were under $20,000 and the income to meet these costs around $17,000. Accurately estimated figures for the year 1959 show cost of services to societies $46,000 and income from societies $33,000. Through the ten years of operation, the societies have never fully paid for the services they were rendered. These deficits have been met from balances saved in economical overhead operation of funds assigned to AIBS for specific tasks. In other words, for every dollar the member biologist invests in AIBS in 1959 he received $1.55 in services. The membership must realize that this is not sound financing and that it sets a definite limit on services rendered. Affiliate societies must realize also that they in turn are sharing in the progress of biology without representation and without adequate taxation. Adjustment of membership dues to cover actual cost of services and more members are equally essential.

Special services rendered biologists by AIBS include at annual meeting time the furnishing of programs and special services including assistance in securing financing of symposia and travel for participating speakers. Many biologists attend foreign meetings through the aid of travel funds secured by AIBS. These services are not restricted to the members of AIBS societies for the objective of AIBS is to serve all

biology within the limits of time and available funds.

Funds administered from grants made for specific purposes have been an important factor in the growth and expansion of AIBS. In 1959, the AIBS will administer over $300,000 in contract and grant funds. The rapid increase in both the number and size of grants from government agencies, foundations and other organizations is indicative of the confidence and trust placed in AIBS. It also illustrates the growing need for the Institute to study, define and report on specific problems in biology on a broad representative basis.

The increase in the total budget of AIBS indicates in part its growth and influence in the cooperative advancement of biology. AIBS in 1959 will operate on a total gross income estimated to be over $600,000. This is in marked contrast to a budget of under $25,000 in 1949.

Committee assignments and procedures. Permanent and special committees that are responsible to the Governing Board study problems in the several areas of biology. They define studies to be undertaken and present the projects to the Board for consideration. Approved projects are organized under directive personnel or smaller committees comprised of qualified, experienced specialists in the subject. A budget to cover travel and other expenses is approved and grants are obtained to meet this budget. The original committee is thereby freed from further responsibilities, other than advisory, and it returns to the study of other problems in its assigned area of biology.

1. The educational committee has studied both material needs and methods of advancing education in biology. The activities of this committee are coordinated with those functioning under AAAS, NRC and other agencies.

Some of the projects resolved and in operation are: a) The Visiting Lecturers Program under which outstanding biologists give lectures and conduct conferences in smaller universities, colleges and, more recently, high schools. Requests for this service have increased steadily. b) The production of two experimental filmed lectures in biology at the collegiate level. c) The preparation and production of a complete biology course at the tenth grade level on films. This course will consist of 120 films each of 30 minutes duration which can be used as a full year's course or units thereof. Individual films can be purchased for supplementary use in high school biology courses. d) The initiation of a long-term course content study of biology courses at all educational levels. This project will begin shortly with a study group under chairmanship of H. Bentley Glass and will be located at the University of Colorado, Boulder, Colorado.

2. The Publications Committee has investigated ways and means of producing society journals; abstracting, indexing and distributing biological information; and has discussed the publication responsibilities of AIBS. These studies have been broadly coordinated with those of similar nature in all fields of science.

A major project of the Committee was the holding of a Conference of Biological Editors from which evolved a study on coordinated journal improvement and unification of journal form. This very likely will lead to the establishment of a joint editorial and business management office within the AIBS for various biological journals.

The publication activities of AIBS have been expanded and now include the *AIBS Bulletin* under a three-member editorial board, the *Quarterly Review of Biology* under a separate advisory board, a symposium series of monographs resulting from symposia organized by the AIBS under a three-member editorial board, and foreign language translations under a six-member editorial board.

The services rendered the several government agencies under specific contracts for organizing advisory committees, conducting symposia, and the register of biologists include: Atomic Energy Commission, National Institutes of Health, National Science Foundation, Office of Naval Research. These agencies have also supported AIBS projects in the field of biology through contracts. The recognition of this valuable support as well as that from private foundations is gratefully acknowledged.

A Biologist Visits Russia

Report of A.I.B.S. Representative to U.S.S.R.

FRED R. CAGLE*

SOVIET biologists are producing knowledge useful to American science. But the American scientist cannot now obtain much of the new information. Difficulty in procurement, the language barrier, and the lack of personal communication together with problems produced by the towering total mass of biological literature inhibit the satisfactory use of the results of Soviet biological research.

This situation demands immediate correction. The U.S.S.R. is challenging the world leadership of the U.S.; the major Soviet instrument is their balanced and intelligent emphasis on basic research. Soviet scientists utilize the knowledge of American biologists; American scientists do not utilize the knowledge of Soviet biologists.

American libraries and individual scholars are making progress in the procurement of literature. Rapidly proliferating (and perhaps confused) translating programs are attacking the language barrier. But we have made little effort to improve the communication between American and Soviet scientists—and such communication can contribute to the solution of procurement and language problems.

The activities of the A.I.B.S. translating program made clear the need for much information that could be obtained only by sending a representative to the U.S.S.R. I was assigned the task of obtaining information useful in the further planning of the translating activities of the A.I.B.S.

Specific objectives of the trip were:

A. To obtain information basic to the selection of Russian biological publications for translation.
   1. Organization and planning in the basic biological sciences in the Soviet Union.
   2. Nature and status of selected institutions producing biological research.
   3. New significant publications in press, in manuscript, or in progress.
   4. Opinions of Soviet colleagues on their literature.
   5. Procedure in publication with particular reference to editorial problems.

B. To obtain information basic to the expansion of exchange agreements (literature, biological materials) between the institutions of North America and the Soviet Union.
   1. Institutions willing to exchange; their desires and regulations.
   2. Procedures and problems.

*Research Coordinator, Tulane University, New Orleans.

FIG. 1. *Equipment in the laboratory of parasitology, Kazakh Academy of Sciences, Alma Ata.*

C. To procure specific biological publications of interest to American biologists.
D. To determine the problems of Soviet biologists in retrieval information.
E. To explore the potentialities of cooperative action, (e.g. International Directory of Hydrobiological Stations; the production and distribution of microforms).
F. To study the graduate education of biologists, particularly in the areas of vertebrate ecology and systematics.
G. To provide Soviet biologists with information about American biology.

The planning of an itinerary required knowledge of names, locations and activities of Soviet government agencies, universities, institutes, refuges, laboratories and libraries. The outlining of planned interviews required knowledge of Soviet literature (lists of serials, major monographs), publishing procedures, editing mechanics, and the areas of primary research emphasis. Staff work during April, May and June, 1958 and the enthusiastic cooperation of American librarians, biologists and administrators permitted the compilation of a sufficient basis to initiate negotiation on an itinerary and to generally plan interviews. The hurried, hectic work demonstrated conclusively that we in the United States had scant information on biology in the U.S.S.R. The work was of value in defining some of the blanks in our knowledge.

Requests for cooperation were addressed to the U.S.S.R. Academy of Sciences and the U.S.S.R. Academy of Agricultural Sciences. Subsequent correspondence produced a confused situation but did stimulate both academies to an interest in the proposed trip. No definitive decision had been gained by the end of July and I proceeded to Moscow on a tourist visa.

Discussion with representatives of the academies and Intourist, colleagues in science, and administrators brought permission to visit scientists and librarians in Moscow, Leningrad, Kiev, Rostov, Odessa, Simferopol, Tbilisi, Irkutsk, Alma Ata, and Tashkent during the period August 11—September 21. The itinerary permitted the visiting of organizations not previously studied by American scientists.

Although all arrangements were made with Intourist, several Soviet colleagues aided by directing letters to each city asking their friends to cooperate. This courteous gesture was of immense value and insured success of my efforts.

Interviews were scheduled with individuals as well as groups. Group meetings usually included six to twenty persons. After preliminary formalities including my explanation of the reasons for my visit and a brief presentation by the chief scientist present, an informal question and answer period was held. A typical meeting continued for two or three hours. These discussions were open and frank. I detected no tendency for scientists outside of Moscow and Leningrad to hesitate in answering my questions. A friendly attitude was always maintained—even under the stress of exceptionally blunt and strongly worded questions and answers.

These meetings were usually followed by visits to laboratories and libraries of the organization involved. These "inspection trips" provided opportunities for brief discussions with many additional biologists and students.

Facilities (offices, laboratories, research collections and libraries) of the following organizations were visited: *Moscow:* Academy of Agricultural Sciences, Academy of Sciences, Institute of Paleontology, Institute of Morphology, Institute of Scientific and Technical Information, University of Moscow, Institute of Oceanology, All-Union Institute of Fisheries and Oceanography, Central Publishing House, Moscow Zoopark, Oka Nature Refuge; *Leningrad:* Institute of Zoology (U.S.S.R.), Institute of Botany (U.S.S.R.), Leningrad University, Leningrad Zoopark; *Kiev:* Ukrainian Academy of Sciences, Institute of Zoology (Uk.S.S.R.), Institute of Botany (Uk.S.S.R.), Institute of Hydrobiology (Uk.S.S.R.), Kiev State University, Museum of Zoology (Uk.S.S.R.); *Tbilisi:* Georgian Academy of Sciences, Institute of Physiology (Georgian S.S.R.), Tbilisi State University; *Irkutsk:* Eastern Branch of the U.S.S.R. Academy of Sciences, Lake Baikal Limnological Station (U.S.S.R. Academy), Institute of Biogeography, Irkutsk State University, Natural History Museum; *Alma Ata:* Kazakh Academy of Science, Institute of Zoology (Kazakh S.S.R.), Institute of Botany (Kazakh S.S.R.), Kazakh State University; *Tashkent:* Institute of Zoology (Uzbek S.S.R.), Institute of Botany (Uzbek S.S.R.), Central Asian State University, Tashkent Zoopark; *Termes:* Termes Zoopark.

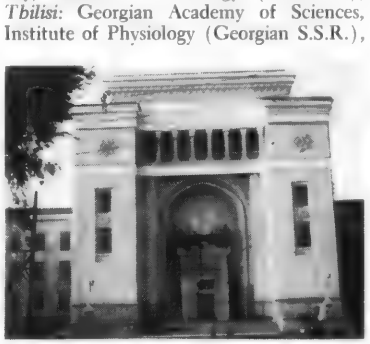

FIG. 2. *Central section of new building of the Kazakh Academy of Sciences, Alma Ata.*

Representatives of additional organizations were interviewed: Institute of Forestry (U.S.S.R.), Botanical Garden (Uzbek S.S.R.), Sevastopol Biological Station, Editorial and Publishing Council (U.S.S.R.), All-Union Entomological Society, Commission on History of Biology in the U.S.S.R., Council for Coordinating Work of the Republic Academies.

Interviews with more than 200 biological scientists and administrators were designed to produce knowledge of several facets of science in the U.S.S.R.—administrative machinery, production of biologists and technicians, editing and publishing procedures, financial support, nature of research, communication, and status of the biologist. The following materials, compiled before leaving the U.S., simplified and expedited discussion: list of Soviet serials available in the Library of Congress and the U.S. Department of Agriculture Library; list of Soviet biological serials arranged by subject matter; list of organizations in the U.S.S.R. concerned with biological research and education; outline of administrative channels for editing and publishing; list of biologists and their research interests.

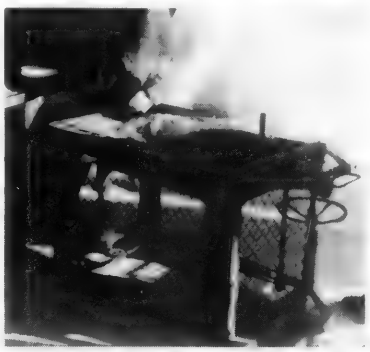

FIG. 3. *A press cage being used in removing a blood sample from the ear of a wolf. Laboratory of parasitology, Alma Ata.*

The lists and outlines were repeatedly submitted to Soviet scientists for comment. The usual reaction was consternation that our knowledge was so incomplete and incorrect. This was usually followed by an offer to provide current information. Some organizations and individuals demonstrated their desire to help by providing lists and outlines. Others that could not furnish them immediately mailed their suggestions to me afterwards in the United States.

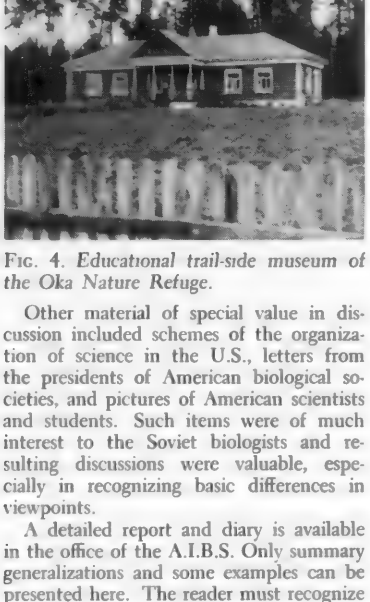

FIG. 4. *Educational trail-side museum of the Oka Nature Refuge.*

Other material of special value in discussion included schemes of the organization of science in the U.S., letters from the presidents of American biological societies, and pictures of American scientists and students. Such items were of much interest to the Soviet biologists and resulting discussions were valuable, especially in recognizing basic differences in viewpoints.

A detailed report and diary is available in the office of the A.I.B.S. Only summary generalizations and some examples can be presented here. The reader must recognize that these generalizations are based only on information gained during 40 days in a vast and complex country. They are presented here in the hope they will be evaluated, questioned, tested and utilized.

Administration of Soviet Biology

Biological research and education are supported primarily by the Academies (Sciences, Medical Sciences, Agricultural Sciences) and the Ministry of Education. In addition, special activities in biology are administered by such organizations as the All-Union Institute of Marine Fisheries and Oceanography. Membership organizations such as the All-Union Entomological Society continue to have an important advisory role but their influence is much reduced. Such societies are attached to a research or education organization. Research and graduate education is concentrated in the Institutes. The Universities are primarily concerned with undergraduate education.

The republic academies are administered quite independently of the U.S.S.R. Academy. Coordination is gained through a special council charged with the responsibility for avoiding duplication of effort. The coordinating council, however, does not ordinarily exert a restricting influence on the republic academies. Especially conspicuous is the pride and enthusiasm of biologists working in the republic academies.

Research planning operates both upward and downward in the administrative hierarchy. In recent years there has been an increasing trend for planning to originate with the individual scientist. This trend has brought greater freedom for the scientist to pursue his own interests. Many research objectives and problems are, of course, formulated in the upper levels of administration but there appears to be a significant decrease in the dictation of research problems and procedures from administrative bodies.

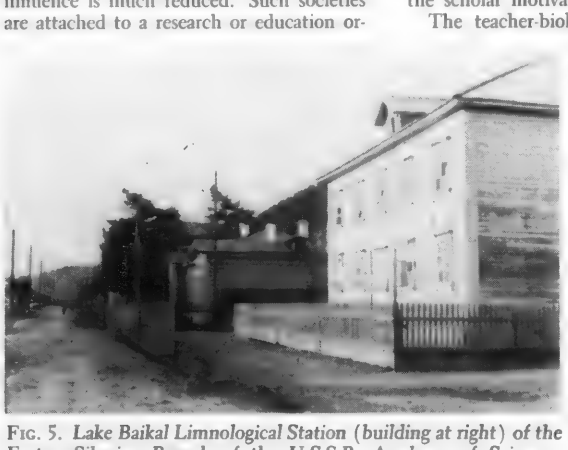

FIG. 5. *Lake Baikal Limnological Station (building at right) of the Eastern-Siberian Branch of the U.S.S.R. Academy of Sciences, near Irkutsk.*

The Soviet Biologists

The typical biologist, after completing five years of university work, becomes a teacher in secondary school or enters graduate study. Until he attains the degree of candidate and thoroughly demonstrates his abilities as a scholar his work is delimited and outlined for him. Once he has attained status with his colleagues, he may be given much freedom to pursue the research in which he is particularly interested. The government has apparently recognized that new knowledge will be produced most efficiently by the scholar motivated by intense interest.

The teacher-biologist in the university is perhaps more restricted. Curriculums in the faculties of biology are precisely outlined by the University of Moscow which also provides descriptions of the subject matter to be presented in each course. Although some flexibility is permitted, the intent is to retain uniformity in instruction between the universities.

The Soviet biologist, well-grounded in the sciences, has responded enthusiastically to a situation that provides him with adequate facilities, assistants, personal income and prestige, and an intellectual climate that permits the possibility of freedom of inquiry. He is friendly toward American scientists, irritated that we do not know of his work, and desirous of cooperating with his American colleagues. His desire to inform Americans is suggested by the many publications in English, summarizing the work of institutes. He is willing to correspond but emphasizes that letter writing in the English language is difficult. Repeatedly he stressed that if American scientists would respond to letters in Russian and write in English that correspondence would be increased.

FIG. 6. *New biological station in construction, Lake Baikal.*

He is winning the battle to insure proper emphasis on the fundamental, experimental and theoretical aspects of biology. He often plays an important administrative part in his government and party.

Communication

The primary instrument for communicating the results of biological knowledge is the services of the Department of Biological Sciences of the Institute of Scientific and Technical Information. This institute not only provides abstracts but operates as an information center dispensing photocopies and translations. The latter services are of great value to biologists outside Moscow and Leningrad as their libraries are generally very inadequate.

The institute employs 1500 people. Of these about 900 are scientist-editors. The biology section has a staff of 120 and uses 2500 abstractors who are paid on a letter basis. The chemistry section has a staff of 300. Journals are received in duplicate. One copy is torn apart and the papers directed to the proper abstractor; the second copy is retained for a library.

The institute will issue three publications in 1959 of major interest to biologists: a subject matter index to Referativnyi Zhurnal; a dictionary of English-Russian terminology in biology; and, a directory of the scientists of the U.S.S.R.

The administrators of the institute are especially anxious to cooperate with American abstracting and information agencies. Such cooperation could substantially benefit both American and Soviet science.

Biological knowledge is published in about 385 technical serials but the bulk of new information is reported in separate monographs. The biologist receives a special stipend for the publication of a monograph. This emphasis on publication outside the established serials makes difficult the routine procurement of Soviet literature by American libraries.

A subject matter classification of the serials suggests the pattern of emphasis in Soviet biology. Of 370 serials: 132 are concerned with general science, botany or zoology; 80, agriculture; 30, medicine; 21, veterinary medicine; 15, physiology; 13, wildlife; 13, ichthyology and fisheries biology; 11, forestry; 10, microbiology; 7, soil biology; 6, oceanography; 6, hydrobiology; 6, parasitology; 5, education; 5, entomology; 3, morphology; 3, paleontology; 2, experimental biology and medicine; 1 each in isotopes, biogeography and terminology.

No complete current list of Soviet serials publishing biological materials has been compiled. The recent and continuing rapid growth of biology has led to many changes in established serials and the introduction of new ones, especially in the republic academies.

The republic libraries are in urgent need of American publications and are desirous of expanding exchange agreements. The library of the Ukrainian Academy of Sciences exchanges with only 3 American organizations. Only one of these, the Library of Congress, is sent all the serials of the Ukrainian Academy. Monographs are not sent except by special requests. The library of Rostov State University receives only 18 foreign biological serials.

Technical serials and monographs are published in limited editions to satisfy only the current, demonstrated need. Publications are often unavailable after the initial distribution. Thus expansion of exchange agreements should be initiated at the earliest possible time.

Foreign technical books are frequently translated into Russian. Royalties are reserved for foreign authors but such funds cannot be removed from the U.S.S.R. This appears to be a currency problem rather than a lack of interest in compensating scientists for the use of their work.

Production of Biologists

More than 90 percent of the biologists are produced by the universities working in cooperation with research institutes. Some zootechnicians are produced by technical schools. The production of biologists is keyed to the requirements for personnel specified by the education system and the academies.

The university program of five years includes the following courses for a biologist, zoologist, or a teacher of biology or chemistry in secondary school: Mathematics, 120 hours; Physics, 150; Chemistry, 312; Anatomy, 72; Botany, 270; Zoology, 282; Embryology, 60; Microbiology, 60; Histology, 24; Neurophysiology, 90; Biochemistry, 90; Plant and Animal Physiology, 240; Biophysics, 24; Darwinism and the History of Biology, 90; Genetics and Selection, 48; Laboratory Practice, 390; Pedagogy, 78; Physical Education, 120; History of Communist Party, 240; Foreign Language, 240; Political Economy, 144; Dialectic and Historical Materialism, 146; Electives, 606. Much of these hours of instruction are included in the first four years; the student is expected to do independent work during the fifth year.

FIG. 7. *The natural history museum at Irkutsk.*

The biologist must work on independent research for two or more additional years to become eligible for the candidate or doctorate degree. On satisfactory completion of his independent studies (usually in an institute) he may be awarded the candidate degree. If his work is very outstanding, he may be awarded a doctorate degree. But, ordinarily, the biologist much work many additional years and demonstrate exceptional stature as a scholar before he will be considered as meriting the doctorate degree. It is not unusual for this period to exceed ten years. The prorector of one university required 12 years after the candidate degree to win the doctorate. A professor of histology required 15 years.

The great majority of the students completing five years of work in a biology (or biology and soils) faculty enter the teaching profession. Only the ablest enter the research institutes as assistants or for graduate study. The number of students entering graduate study is regulated by the needs expressed by government for biologists. Three university administrators reported that the requests for biologists with advanced degrees had been decreasing during the last three years. Research administrators repeatedly stressed a continuing need for exceptionally competent biologists.

The size of institutes and university faculties in biology suggests the need for biologists. The Institute of Zoology of the U.S.S.R. Academy of Sciences has 40 zoologists (8 with doctorates). The Institute of Hydrobiology of the Ukrainian Academy has a staff of 100 of which 51 are scientists. The Institute of Physiology of the Georgian Academy employs 52 scientists. One of the smaller academies, the Uzbek Academy, has 13 institutes or their equivalent concerned with biology. The Kazakh State University has a biology faculty of 30 (5 with doctorates); Irkutsk State University has an agro-biology faculty of 25 (3 with doctorates); Rostov State University has a faculty of 34 (1 with the doctorate).

Facilities

The research facilities are not elaborate by American standards but are generally adequate (Fig. 1). Instrumentation, storage of research materials, and design of laboratories are unsophisticated. But this is no great handicap in research programs having an abundance of technical assistants.

Facilities are being rapidly expanded and improved. The new building of the Kazakh Academy of Sciences and the new quarters of the Laboratory of Parasitology at Alma Ata (Figs. 2, 3) are well designed and equipped. If these are representative of other facilities under construction, Soviet biologists will be well housed.

The instructional facilities for biology and the universities (other than Moscow University) are often inadequate and neglected. The teaching staffs must be enormously handicapped by the lack of proper laboratories, classrooms and teaching aids.

Opportunities for field research and teaching are furnished by nature refuges. These are well-staffed by biologists trained in conservation, research, and education. The Oka Nature Refuge, 110 kilometers south of Moscow, has laboratories, a museum, and special facilities for experimental breeding of bison (Fig. 4).

Numerous biological stations have been established. Perhaps the best known is the Lake Baikal Limnological Station of the Eastern Siberian Branch of the U.S.S.R. Academy of Sciences (Fig. 5). A new station providing ample housing and laboratories for visiting investigators is in construction. (Fig. 6.)

The zooparks are also extensively utilized

FIG. 8. *A conservation poster on a rural road in eastern Siberia.*

in biological education and some have special research laboratories. (Fig. 7.)

There are no great natural history exhibit museums of the stature of the American Museum of Natural History. The many museums do, however, have excellent, well maintained research collections and exhibits in the fashion of early American natural history cabinets (Fig. 7).

Support of Biology

The value of biology in the development of the U.S.S.R. appears to be coldly and realistically recognized. Research and instruction is regulated by the need for specified knowledge. Too, the great prestige of biologists and their occasional direct participation in administrative decisions brings about a substantial emphasis on the fundamental and theoretical aspects of biology.

The needs for biological knowledge in the U.S.S.R. differ somewhat from the needs for biological knowledge in the U.S. These differences are reflected in relative emphasis placed on different fields of biology. Thus the pressure of vast, undeveloped areas of land has led to much emphasis in taxonomy, ecology, soil biology, wildlife research, hydrobiology, forestry, animal disease and conservation. Such fields have not won significant support in the U.S.

The Soviet Union has a substantial advantage over the U.S. in that the Soviet citizen has been generally educated in science. A public literate in science supports science. The Soviet layman knows about science, is proud of the accomplishments of science, and can talk intelligently about the Institutes of Zoology and Botany in his city or republic. The party member has had further thorough indoctrination in the need for the results of scientific endeavor. Thus the central role of the party in planning has benefited the development of both education and research in science.

Exceptional emphasis on conservation (Fig. 8) has brought supplementary support to biology.

Results of the trip.

1. The following materials were obtained: corrected lists of Soviet serials; recent publications especially monographs and copies of serials not available in the U.S.; lists of personnel; outlines of organization; reports summarizing activities of institutes.
2. The following information was obtained: recommendations of Soviet scientists of materials to be translated; needs for American literature and research material; attitude, position and role of the Soviet biologist; patterns of graduate education in biology; general information on the status of Soviet biology.
3. Personal communication was established with Soviet biologists and their interests and desires recorded.
4. A preliminary basis was established for other biologists to visit the U.S.S.R.
5. Problems involving the translating program were defined.
6. Soviet biologists were informed about the administration of American science and the role of A.I.B.S.
7. Specific proposals of Soviet scientists for further cooperation were obtained.

General actions recommended

Many of the smaller actions required to implement further communication are not outlined here (e.g. sending of lists of American scientists and research materials).

1. The U.S. should immediately send biologists and librarians as tourists to visit their colleagues in the U.S.S.R. These Americans should not travel as delegations or teams. They should be thoroughly briefed by American scientists having recent experience in the U.S.S.R. The principal objective should be to increase personal communication. Such travel can be arranged without excessive difficulty through Intourist.
2. The U.S. should implement the travel of Soviet scientists to the United States. The closed area concept should be abandoned except where such restrictions are essential for security reasons.
3. The A.I.B.S. should establish a center for collecting and dispensing information on Soviet biology. The activities of the center should include the publication of news of Soviet biology and summaries of the work of Soviet organizations.
4. American libraries should intensify their efforts to establish exchange agreements with Soviet libraries. Emphasis should be placed on dealing with individual librarians in the republics.
5. The abstracting services in American biology should explore the feasibility of cooperative action with the Institute of Scientific and Technical Information.
6. The agencies involved in translation of Soviet technical materials should take action to establish agreements with the responsible Soviet agencies. Such agreements may well yield much profit to biology and to individual authors. As a minimum, discussions would produce better mutual understanding of problems.
7. The translating of Soviet materials should be closely coordinated and selections of material for translation made by panels of biologists expert in the fields concerned. The opinion of Soviet experts should be utilized.
8. The translating program should accept as its first responsibility the translation and distribution of the most useful bibliographic tools.
9. Action must be taken to place in the hands of biologists the routine announcements of new Soviet monographs in biology.
10. The editors of American journals should be encouraged to publish abstracts in Russian. A.I.B.S. should gain government support of an office to prepare such abstracts if the cooperation of journal editors can be gained.

Biological Overtones of the Thermal Theory of Biochemical Origins

SIDNEY W. FOX, *Florida State University*

Introduction

DURING the present decade, the problem of spontaneous generation has become an area of chemical experimentation. Either the objective of understanding the origin of life or that of attaining the utilitarian goal of producing a living cell artificially poses, however, biological problems. Furthermore, most biologists will probably agree that solution of the chemical problem is properly guided by the boundaries set by biological principles. The value of such guidance is a consequence of the premise that all phenomena are manifestations of, and have their roots in, previous phenomena. This is a point of view to which the biologist is especially prone because of his daily observations. The concept that prebiochemical processes and biological processes are closely related parts of an overall evolutionary continuum is likely to be axiomatic also for the geologist and astronomer. This interplay between chemical and biological modes of thinking is evident in some of the recent researches in the field.

Undoubtedly many or most humans have devoted thought to their remote origins. Books which have attempted to outline the

origins of life in a natural way are to be found in numbers in many sizeable libraries. The best known of these conjectural treatments is that of "The Origin of Life on the Earth," by the Russian academician A. I. Oparin, but many American, British, French, and other authors have developed this topic in an essentially mechanistic manner, e.g., J. D. Bernal of England, in his "The Physical Basis of Life".

The salient feature of the present decade is that knowledge and speculation had reached a stage at which experimentation could begin. Insofar as the author is aware, the first bold experiments constructed for the express purpose of understanding the primordial origin of organic compounds found in organisms were those of Melvin Calvin of the University of California. Calvin and coworkers published in 1951 a report that they had converted CO_2 and H_2O to HCHO and HCOOH by a helium ion beam. From HCHO it is possible to visualize production of many compounds with the necessary carbon-to-carbon bonds. A spectacular and stimulatory experiment which led to the production of amino acids was reported in 1953 by Stanley Miller, working as a graduate student with Harold Urey. Since 1953 amino acids have been produced in many ways under conditions and from many inorganic and simple compounds that can be construed as prebiological. The compounds employed have comprised carbon monoxide, carbon dioxide, methane, formaldehyde, hydrogen, water, nitrogen, ammonia, nitrate, ammonium carbonate, glucose, acetic acid, malic acid, other amino acids, and the forms of energy have included electricity, solar or ultraviolet radiation, β-rays, γ-rays, X-rays, and heat.

The Thermal Theory

Most of the publications in the area of experimentation with biochemical origins have dealt with the production of amino acids. There can be little doubt that interest in the amino acids in this connection derives from the fact that they are the molecular units from which proteins are constructed, coupled with the fact that it is at least extremely difficult to visualize a primordial organism which was not largely dependent upon and partly constructed from protein. The more central problem, then, as pointed out by Blum and others, is the origin of protein.

The production of a complex polymer closely resembling protein of current organisms and possibly virtually identical with primordial protein (by virtue of content of D-amino acids) has recently been announced (1). This material is produced at a temperature above the boiling point of water in the absence, however, of water other than that resulting as a byproduct from the formation of peptide bonds. The materials obtained give, after hydrolysis, ninhydrin-stained chromatograms like those from casein, have molecular weights comparable to those of proteins, can be salted out of aqueous solution, yield infrared absorption patterns and color tests like those from protein, and can substitute in part for peptone in bacterial culture media. The chemistry of the *pansynthesis* is indeed complicated, but a critical feature is inclusion of an excess of dicarboxylic amino acid. Without this excess the reaction mixtures are hopeless messes, as a well documented literature and experiences of amino acid chemists would lead one to expect.

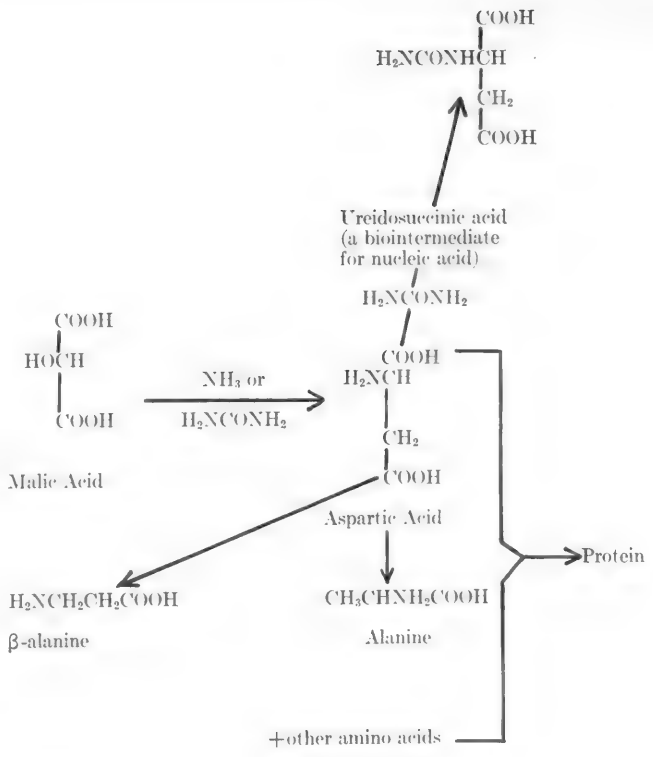

FIGURE 1

Prior to the recent accomplishment of the pansynthesis of the presumed primordial protein, the research in the author's laboratory was diverted to verifying a succession of mostly unanticipated findings (2). Some of these reactions were sought on the basis of evolutionary thinking, but many of the results were quite unexpected. A salient part of these results is presented in Figure 1. This flowsheet can be interpreted to indicate that numerous linked reactions arose spontaneously, that enzymic protein was generated in the presence of the continuous reaction products, and that genic nucleic acid (on the basis of finding ureidosuccinic acid) helped to fix a record of chemical occurrences up to the moment of its own synthesis.

Biological Overtones

For a more detailed treatment of the thermal studies, other papers as cited should be consulted. The material in this paper will be confined mainly to consideration of the theoretical biological significance of such studies.

Regardless of how continuous may have been the transition from a prebiochemical world to one containing life, our knowledge of the periods before and after must mark the border where chemistry and biology can truly be said to meet. It is possible to trace an evolution of protein molecules (3) back through organisms, albeit inadequately, and now to postulate a forward chemical development of protein molecules. The entire process is an evolution, in the larger sense, at the molecular level and in part it has features which can be related to Darwinian evolution, e.g., variation and selection (3).

The main theme which can be seen to be running through the entire comprehensive picture is a biogenetic one. The thermal flowsheet of Figure 1 and some of its more elaborate counterparts (2) are striking, not only because they contain the same micromolecules as are found in nature, but also because the sequences by which these arise thermally are in the same order as such reactions occur in a generalized biosynthesis. If the biogenetic principle, stating that the development of an organism reflects its evolution, is correct, a naturalist should then expect the law to be reducible to the chemical level. When we regard the thermal pathways as prebiological pathways, we have reduced the biogenetic law to the chemical level and spanned the prebiological and biological eras in an essentially Darwinian continuum. Also, we may thus visualize that the complex administrative

substances, the nucleic acids and/or nucleoproteins, have appeared at a late stage when the business is complete, and thus available for effective administration.

The concepts of this last paragraph are to a large degree inferences from experiments rather than merely working premises. They represent outlooks which differ, however, from premises in other current interpretations of the primordial world. These other points of view are based on the assumption that (1) prebiological chemistry must have been greatly different from biological chemistry, and (2) that nucleoproteins came before most or all of cellular chemistry. The first outlook seems to be most popular with nonbiologists, but this cannot be said for the second, which is often heard from geneticists. The argument in this second case is simply that since the gene is fundamentally determinant in living systems, DNA must have come first in prelife. The objection to this is essentially chemical, and is based on the premise that complexity is approached through simplicity, in agreement with the trend in the developing biosynthesis in the cell. Without the premise that complexity must have arisen from simplicity, the concept of a chemical memory mechanism becomes untenable and, if one assumes that the numerous chemical reactions arose later, it is also unnecessary. At least some reactions involving simpler intermediates than nucleoprotein must have preceded nucleoprotein.

A basically biological point of view holds that no individual lives in an environmental vacuum and that to understand individuals we must understand their interactions. Put another way, it has been said that all biologists need to be ecologists. For reasons such as these, it is significant that profound effects are observed in the thermal interactions of amino acids, in modes of behavior that do not occur in the individuals. When, for example, glutamic acid is heated alone, there results α-pyrrolidone-carboxylic acid, not a peptide. When leucine is heated alone, no peptide is formed; only a diketopiperazine and tar are observed. If the two amino acids are heated together, there results a linear peptide, of the type sought. Interactions, then, are providing results which cannot be obtained with the individuals, in a kind of molecular ecology. At yet another level, we can conclude that the total effect requires organization, a perspective which the biochemist is these days reacquiring from the general biologist, after a decades-long sojourn with isolated systems. The interaction effect of glutamic acid and leucine is but one component of a complex of phenomena which permit the pansynthesis of proteinoid (1).

The thermal mechanisms are also consistent with biological mechanisms in that both are dynamic and persistent. In this respect the thermal mode is properly regarded as a radiation mechanism along with the solar, and β-, γ-, and X-radiation, all in contrast to intermittent electrical effects. Radiation is favored as a likely form of energy for prebiological systems because living organisms are characteristically continuous in their development and dynamics. In the last two decades biochemists have come to recognize the dynamic chemical nature of organisms. Perhaps a truer emphasis is that the individual cell is at any moment proceeding in some phase of its development; dynamism is an essential concomitant of the development. The picture of thermal origins is consistent with this emphasis.

The thermal studies have also yielded the interesting result that all of the unexpected micromolecules which have been identified (many clues are yet to be studied) represent substances which have been identified as present in some living system. In a more specific way, the dominance of the dicarboxylic amino acids in the thermal pansynthesis parallels their dominance in biological systems. They are found in excess of most or all other amino acids in proteins and in the free state in fluids of plants and animals. Braunstein and others have emphasized their key importance in the biosynthesis of protein. Moreover, recent experiments have demonstrated that although each dicarboxylic amino acid is effective in copolymerizations, aspartic acid is the critical one of the two in thermal synthesis of the protein-like materials. This is parallel to Braunstein's conclusion that aspartic acid is the more primitive of the two and comports with the early role of aspartic acid in biosynthesis.

It is perhaps not surprising that one can find parallelisms between the thermal pathways and the extensive biochemical literature. It is of interest, however, that some of these relationships appear to have been suggested first from the thermal studies. For example, the confluence of the tricarboxylic acid cycle, the urea cycle, and pyrimidine biosynthesis was first proposed in 1955 in a symposium, from the thermal studies. In 1956, Reichard and Hansoff made the same suggestion in *Acta Chemica Scandinavica* on the basis of conventional biochemical experiments. In another instance of parallelism, the details of direct thermal conversion of malate to aspartate were reported in 1955, and in fact had been described in essence purely as organic chemistry in 1850. Conversions of fumarate or oxaloacetate to aspartate have been accepted as biochemical pathways for many years. In 1958, definitive experiments on direct biochemical conversion of malate to aspartate were reported. It can now be inferred that the malate conversion was more primitive, having been superseded in evolution by more efficient biochemical conversions from fumarate or oxaloacetate. The malate conversion could be found also, if it were sought and if it were there, as it appears to be.

Finally, interpretations of the thermal theory lead to the concept of a memory mechanism at the chemical level as at the biological level, as has been pointed out. This is also consistent with biogenetic thinking. The individual cell can be considered to be reenacting the chemical history by which it came into existence, because the final fruit of this development was a chemical memory mechanism, i.e., a system for detailed reproduction of successive biochemical events.

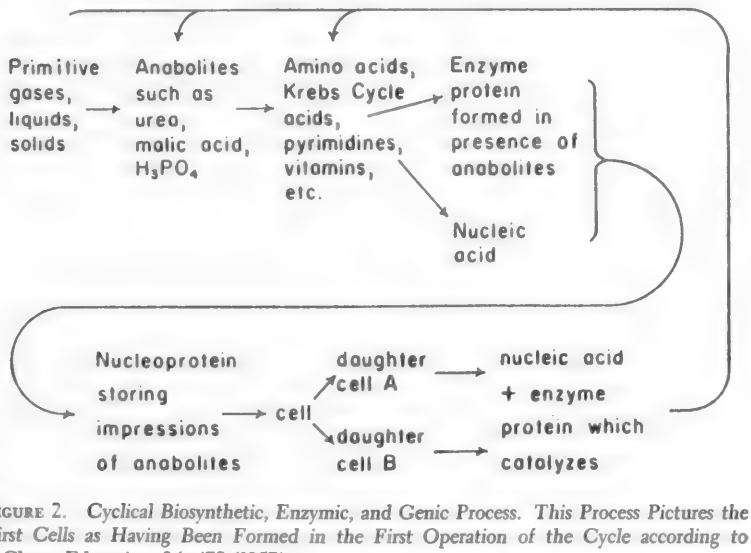
Primitive gases, liquids, solids
Anabolites such as urea, malic acid, H_3PO_4
Amino acids, Krebs Cycle acids, pyrimidines, vitamins, etc.
Enzyme protein formed in presence of anabolites
Nucleic acid
Nucleoprotein storing impressions of anabolites
cell
daughter cell A
daughter cell B
nucleic acid + enzyme protein which catalyzes

FIGURE 2. *Cyclical Biosynthetic, Enzymic, and Genic Process. This Process Pictures the First Cells as Having Been Formed in the First Operation of the Cycle according to* J. Chem. Education, *34, 472 (1957).*

Conclusion

The first to conclude that life had thermal origins were several classical biologists, such as Copeland in this country. Biochemistry was not at the time of these works sufficiently advanced that independent chemical research leading to the same general conclusion could be performed. Humans, in their usual egocentric fashion, often devise mental obstacles to life at the temperatures of hot water, but organisms

morphologically simpler than humans and such as those in the hot pools at Yellowstone manage to thrive very well. Copeland concluded that these are ancestral to cold water forms.

Reason to believe that any theory of the origin of life is correct will be fortified if a living unit is synthesized under the conditions of the theory. Although arguments persist about the definition of what is living, artificial production from inanimate materials of an entity which can generate more of its kind in the absence of other living material should generally satisfy the requirements of a successful demonstration of production of life. Such a dramatic event would, however, not conclusively prove that life began in this fashion. On the other hand, such a demonstration is not necessarily required to validate a theory of origins. Analogously, it was not necessary for the acceptance of and guidance by Darwin's theory of lineal evolution of organisms to demonstrate its essential correctness by a signal experiment, if one could have been devised.

Among the ways in which a theory of origins can be tested is to determine its intraconsistency and its interconsistency with other knowledge. The thermal theory has reached a stage of relative comprehensiveness at which it is available for general critical consideration of its consistence with other knowledge.

The total picture, in summary, is a spontaneous generation of linked chemical reactions (subsequently anabolic reactions), enzymic protein (1), and genic nucleic acid (3), in accord with Figure 2. If this picture of thermal origins or any other is indeed extensively consistent with other knowledge, we can seriously entertain the belief that science is on the "right track" toward answering one of man's oldest and most provocative problems.

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Science Education—A Threefold Problem

SYDNEY S. GREENFIELD, *Rutgers, The State University, Newark, N. J.*

AS YOU can tell by reading the newspapers, it is now clear to almost everyone, that our national program in science and mathematics is very inadequate, that we have a great shortage of well trained teachers and that something must be done about it very soon. Will we, however, look beyond our hurt national pride and thoroughly analyze the situation so that we will know just what is wrong and how we can improve American education?

To do so we shall have to give much greater attention to the quality of our education and less to the quantity of persons taught; and give emphasis to the serious matter of what is to be taught, and how it will develop the minds of our youth, and not dwell on the less important problems of teaching methods and making the school a multi-purpose social institution. Reemphasis should be placed on the integrity of knowledge as opposed to the machinery of teaching. The problems with which we are confronted are not simple, and there are no easy solutions.

In the first place, let me say that the urgent need to improve American education is not limited to the field of science, but applies as well to the social studies and to the humanities. While we have concentrated on constructing beautiful new buildings in recent decades, we have permitted the curriculum to become invaded by training in skills, by play, by courses in social behavior, and by other activities that dilute the genuine intellectual experience which is vital to education at all levels.

Condensation of address delivered at the Annual Founders' Day luncheon of the Bergen County (N. J.) Council of Parent-Teachers Associations, February 18, 1958.

Of course, our attitude towards our schools reflects the attitudes of our contemporary culture, and as a people, we are too much concerned with appearances and not with genuine values. A beautiful modern building does not mean that a school is good; it is more likely an indication of the quality of the architect and the taste of the school board. It is false economy to spend millions for modern buildings while paying small salaries that intelligent and educated young men and women will not accept. Such generalizations of course cannot apply to an entire country, as large and as varied as ours. As you know, in some areas we have excellent schools with very good teachers and curricula, but unfortunately they seem to be in the minority. All too frequently teachers are hired who have little or no training in the fields that they are required to teach. It is estimated that only one third of American high school teachers of science and mathematics majored in these fields in college.

We have built a multitude of educational institutions. As a nation we take great pride in the enormous number of diplomas and degrees that we grant each year. But these diplomas and degrees have no meaning except in relation to the particular institution that grants them. Some of our schools and colleges are excellent, among the best in the world, but we have others from which students graduate mainly due to the passage of time, and by wearing out the furniture.

If we aim to offer equal opportunity for all American youth, we have a long way to go. On a nationwide basis, we need a thorough re-examination of our educational system with a view towards upgrading standards, eliminating non-educational activities, and insisting on work of genuine intellectual caliber in all fields. We ought to seek to establish clearly defined national standards of achievement and excellence for high school diplomas and for college and university degrees.

In the sciences, we need to plan a comprehensive program of both physical and biological science throughout the grade schools and the high schools. The same should be done with mathematics. By this I mean that every student, not only those who go to college, but even those who do not, should have much more intensive work in science and mathematics than is now offered, every day from the first grade of the elementary school through high school graduation. Science has long been a major factor in our civilization, and has become an ever increasingly important part of our cultural heritage. However, since the 19th century the constant struggle to achieve a proper role for science education in our schools has met with only limited success.

Even now, when the enormous need to improve American education is widely recognized, fears are being voiced by some that we may put too much emphasis on science. We shall have to dispel these fears by pointing out the great deficiencies in our present program, and that it will take supreme efforts to achieve even part of a really adequate program in science. Also, we shall have to distinguish between science and gadgetry, for too many people genuinely confuse science and technology. They do not understand the importance of cultivating science for its own special values, its objective search for the truth, its

creativeness, its readiness to acknowledge error and to accept new ideas.

On a nationwide basis it would seem almost impossible to achieve an adequate program in science and mathematics for our schools. The shortage of competent teachers is acute and will be for a long time to come. Unless great efforts are made to re-educate present teachers, to improve teacher education, and to recruit well-educated, articulate and stimulating young teachers, only small scale improvements will occur.

Our problem is therefore threefold. We must plan an adequate program of studies for all grades, we must try to obtain well-trained teachers to carry out the program, and we must provide a national cultural atmosphere in which rigorous learning and genuine intellectual activity are appreciated.

The design of a new and adequate curriculum in science for all grades is a large task that will require considerable study. It should be done by teachers of superior ability who are familiar with the problems of teaching the age groups in question, in cooperation with specialists in all fields of science who are also capable of understanding the implications of their fields in the general education of children and teenagers. I believe that we have the necessary talent in our grade schools, high schools and colleges. We need to bring them together to work for the common good. This could be done by national professional societies, state universities, or foundations.

In the lowest grades of school we should be teaching natural history. Here we can teach the nature of plants and animals, rocks and minerals, and the stars. Through the grades, a great deal of descriptive botany, zoology and geology can be taught. Leaf and insect collections, studies of flowers, trees, shrubs, birds, rocks, etc., will expand the horizons of our youngsters, and provide a broad background for more analytical work later on. The use of color motion pictures to show the variety of life and the nature of the physical environment can accomplish much, especially where the teachers are not prepared to handle the many broad aspects of natural history. We should aim to encourage curiosity, to sharpen powers of observation, and to inculcate habits of questioning and exploring nature.

In later grades, or as soon as children are able to handle it, we should begin to teach them the meaning of experimentation and analysis. Here, for example, students should be studying living plants and animals, making careful observations on their growth and behavior, and performing various tests to answer questions. Similar experimental work should be done in the physical sciences.

In the junior and senior high schools, we need to plan much more intensive work in science than has yet been done even in our best schools. What is now covered in the general science courses of the high school should have been thoroughly explored in lower grades, and we should give comprehensive descriptive and experimental work in botany, zoology, geology, chemistry, physics, geography, and astronomy, not on a 'take one if you please' basis, but practically all of these to all students. Intensive one semester courses could be developed in each of these fields, or they might be presented as much broader courses in physical and biological sciences. Our new courses should include much more laboratory work than has until now been given in high schools. The upper level courses in the high school ought to take over the work now commonly taught as freshman introductory courses in college, so that the colleges can start at a more appropriate advanced level.

Just as important as the subject matter to be covered is teaching the spirit of science, and this is an area in which our schools and colleges are often deficient. We tend to teach the sciences as if we were preaching dogma. Instead we should be telling our students that we are discussing tentative conclusions which are thus far supported by the available evidence. We need to emphasize the questioning spirit that sparks discovery, that readiness to recognize error and to accept new ideas. We need to encourage our students to think, to ask questions, and to seek the answers, as often as they can, by observation and experiment, and not always by finding it in the book. On all levels, our students must have the experience of asking questions, of designing experiments, and of obtaining what is most precious in science—objective evidence. We must teach them to ask: What is true? How do you know? How reliable is the evidence?

In the field of mathematics, much work needs to be done. It is recognized that a thorough revision of courses in both high schools and colleges is necessary. A number of mathematics groups and teachers of mathematics have been at work on this problem and new curricula are being developed.

The problem of designing adequate curricula in science and mathematics, or indeed in any area of knowledge is not too difficult. We have the necessary talent, and now greatly increased motivation. If we arrange to have the experts in various fields work with the teachers, we will surely produce the courses of study needed to upgrade instruction in our schools and to challenge our talented youth.

More important than providing curricula and physical facilities, is the problem of providing adequate numbers of competently trained teachers to put our plans into effect. Here is where we will encounter serious difficulties. As you know, we now have a great shortage of teachers, especially in the areas of science and mathematics. In addition, many of the teachers in our schools are not prepared to teach present courses in science and mathematics, and we can hardly expect them to offer a new, more advanced and intensive program. Therefore, we have the double task of re-educating many present teachers, as well as obtaining many new teachers who are well educated in their respective fields.

With regard to in-service teachers, specific proposals can be made. For those teachers who have had little or no training in the subject matter areas, as well as those who have been teaching a long time and may need up-to-date refresher courses, special lecture and laboratory courses should be provided that are comparable with high level college courses. The method of offering these courses will vary with local conditions across the country. But in a metropolitan area the program should present no special difficulties. The courses could be sponsored jointly by boards of education, on a county-wide, or state-wide, basis. They could be offered at centrally located high schools or colleges, and be taught in the late afternoon or evening by professors from colleges and universities in the area, as well as by those high school teachers who are well qualified in their subjects. In many parts of the U. S. there will be few if any high school teachers capable of giving these courses, but in northern New Jersey, New York City, Chicago, California, etc., there should be a considerable number of teachers qualified for the job.

Boards of education will need to work out a system whereby teachers who improve themselves with such courses in science or mathematics, or indeed other fields of knowledge, will receive credit for them, translatable into salary increases. I must insist that here I am referring only to courses in the subject matter fields.

On the other hand, teachers who have had good undergraduate training in special fields, should be encouraged to continue their studies by doing graduate work at universities within commuting distance, during the academic year, or during summer sessions. Universities should plan to accommodate in-service teachers who wish to pursue graduate studies on the master's degree level in science and mathematics, by scheduling courses in the evenings, on Saturdays and during summers, when teachers are free to take such courses.

Special salary increments should be given to those who earn master's degrees in science, mathematics, languages, history, and other fields of knowledge, and some attention should be paid to the quality of the degree granting institution. Since graduate instruction is usually expensive, the major share of this task should fall to state universities and city colleges, where tuition rates can be kept relatively low. Graduate work in education for high school teachers should be strongly discouraged.

The recruitment of new teachers of excellent quality and in adequate numbers is an imposing challenge. It will involve a realistic appraisal of the factors that discourage many intelligent young men and women from entering the profession.

There are many factors that operate to create a teacher shortage, and one of the most important is the salary level. In our expanding and inflationary economy, teachers' salaries have simply not kept pace with other salaries, and many young men and women who might like to teach, turn

instead to more lucrative occupations. Another factor is the failure of the schools to awaken intellectual curiosity, so that many who might have enjoyed lives of scholarship and teaching are never led to understand the genuine satisfactions of study and teaching. Moreover, those who do appreciate the possibilities in a teaching career are often deterred from going into elementary and secondary school teaching by the bland, multi-purpose, social character that has been imposed on many of our schools. I mean, of course, the schools that tend towards turning out homogenized, life-adjusted, agreeable conformists, instead of alert, informed and questioning minds.

Therefore, in order to attract the bright young people that we need, we shall have to raise salaries to a level that is acceptable to the best talent, and we shall have to return the schools to their proper function, that of rigorous intellectual training in history, literature, languages, mathematics, physical and biological science, and other areas of genuine knowledge. Our teachers should be trained in first rate liberal arts colleges, and be encouraged to undertake graduate study in scholarly fields. Just as we have abandoned the "Normal School" idea, we should now aim to educate all of our teachers in first rate liberal arts colleges.

Further, I think we need to drastically reduce the requirement of education courses in teacher certification. Certainly our teachers need instruction in principles and methods of the profession, but surely it need not be spread out over so many semesters. The history, philosophy and methods of education can probably be taught very adequately in two, or at most, three semester courses. Such courses should be much better than most of the present courses in education, which are so repugnant to first rate minds. Some of these courses are aptly described as "the unctuous elaboration of the obvious". It seems to me that they have two deleterious effects. First, they discourage the bright student by giving him a poor opinion of teaching, and of the profession, and in the second place, they use time that might be spent on genuinely intellectual disciplines.

As I see it, the key to the whole problem in American education is the teacher, and we should spare no effort to obtain a staff of well-educated, inspiring teachers. Nevertheless, it seems to me that whatever we do, we will not be able to obtain enough well trained teachers to staff all of our schools. The shortage will be particularly acute in the sciences and mathematics. What then shall we do? I believe that there is no substitute for the good teacher, but if we simply do not have enough good teachers to go around, we shall have to resort to the use of devices such as television and the motion picture. Thus far, experiments with television are promising and the motion picture seems to be a most useful tool. I should like to explain briefly how I think it might be used to greater advantage.

A year ago a professor from the University of California taught a course in physics to about 700 high school students in the Pittsburgh area, over a local educational television station. The course was recorded on film and this year is being offered to about 75,000 students in 14 states. Next year the course may be offered more widely in North America, as well as in Europe, Africa, and Australia. A similar project is planned for high school chemistry, and other subjects are being considered.

Now it must be admitted that any film provides a passive experience for the pupil. He cannot ask it questions, or participate in the action. However, the device makes it possible to show him experiments that he otherwise could not see, as well as to let him see and hear some of the best teachers in America. If teachers in these subjects cannot be obtained locally, these films will perform a valuable service. Where qualified chemistry and physics teachers are available, the films should form a valuable adjunct to teaching.

It seems to me that films are most useful in the informational aspects of teaching, but they should never be allowed to replace objective laboratory experience. Consider the enormous potential of the medium in the biological sciences, where full color, large screen, sound films might bring the whole world of living things into the classroom. These teaching films, as I see them, should be made by experts with professional film-making skills such as are exhibited by the Walt Disney studios, and others who have made commercial nature films. But they should be scientifically very accurate. Whole courses could be filmed in planned sequences, and be shown all over the country. Their value in providing visual experiences of the physical and biological environment, of laboratories and experiments, to every school in the country, should more than justify the cost. Consider also the enormous potential value of such films in other fields, such as history and geography.

All the proposals that we can make for new buildings, for upgrading the schools, for rigorous intellectual curricula, for better trained and better paid teachers are not enough, unless the society in which we live will support better schools. By this I do not mean only financial support, which I think we may get. We need a society that has a genuine love of learning, and an appreciation of scholarship. We need a society that is concerned with genuine values and in which facade and fakery are deplored. Only in such a climate can we establish and maintain excellent schools. Unfortunately, our contemporary culture is too much concerned with material pleasures. It tends to tolerate its schools as necessary, but somewhat bothersome institutions. Indeed, in some ways it is essentially anti-intellectual and tends to distrust the human mind whenever it operates above the mass level. You need only to listen to the vast majority of advertising slogans and statements to know in what contempt we hold ourselves.

We shall need to change the values of American society so that they are more spiritual and intellectual and less material. This is certainly not a new proposal for it has been advocated throughout our history. However, until now, we have been able to get by with an emphasis on conspicuous consumption while a minority of scholars and scientists have kept learning alive. Suddenly, all this has changed. We are now competing with nations which may not possess our material wealth, but possess a revolutionary vitality that emphasizes cultural and scientific achievements. Make no mistake about it, the achievement in America of a more mature culture, in which there is a real love of learning, a respect for education and scholarly accomplishment, a respect for the moral and ethical values that are basic in our national heritage, is no mere luxury. Upon this achievement rests the survival of western civilization.

In order to achieve a change of values, we may have to adopt some of the methods of advertising that keep us on such a high pitch of buying what we need, and more often what we do not need. We shall have to plan aggressive campaigns to educate the American public at large as to the values and the great pleasures of reading and studying. It will require the cooperative efforts of all educational and community agencies, and we must be sure that we are inculcating genuine values, and not, as is more often the case, selling other slogans.

All is not well in American education and it will take greater effort by all of us to analyze what is wrong, and to see what we can do about creating better schools. But as I said at the beginning, we shall have to turn our major attention to the quality of our education and away from the quantity of persons taught; and to the serious matter of what is to be taught and how to develop the minds of our youth, and away from the less important problems of the machinery of teaching. What concerns us is the inside of the package, and not the wrapping!

1959 ANNUAL AIBS MEETINGS

Pennsylvania State University — **University Park, Pa.**

August 30–September 3 — **August 30–September 3**

An Analysis of Salary Data of Biologists from the National Register of Scientific and Technical Personnel

HIDEN T. COX and JOAN V. BATTERTON

ALMOST a year ago the United States Civil Service Commission announced increases in salary to "top-of-grade" for physicists, some chemists, engineers and certain other scientists employed by the Federal Government. Biologists were not included.

Since the AIBS is not a Federal agency, it could not request a review by the Civil Service Commission of this action. The Institute did present arguments concerning the serious consequences which will result in recruitment of able biologists to federal service, in the prestige of biology as a profession, and in the Federal scientific program generally.

As supporting material to these arguments, the AIBS prepared and presented to the Commission a survey of biologists' salaries in 1954 and 1956. These salary data were compiled for biologists at various academic degree levels and in different categories of employment. Data were taken from questionnaires returned by biologists in response to the 1954 and 1956 canvasses of the National Register of Scientific and Technical Personnel and the cooperation of the National Science Foundation in this survey is gratefully acknowledged.

The 1954 data are compiled from questionnaires distributed during that year and returned during 1954 and 1955. Similarly, the 1956 data are from questionnaires returned during 1956 and 1957. Questionnaires were sent to all AIBS Member and Affiliate Societies and to several societies which are not affiliated with the AIBS. The societies of the Federation of American Societies for Experimental Biology and certain other societies with interests allied to FASEB were not canvassed; and, therefore, data concerning these biologists are not included in the AIBS study. The AIBS study includes data from 15,628 biologists responding to the 1954 canvass and 14,320 responding to the 1956 canvass. Table I depicts the distribution of these biologists at the baccalaureate, masters and doctorate levels by type of employer. Only full-time employed male biologists are included.

Median salaries of biologists included in this study are shown in Table II. Median salaries were computed from data for 1954 and for 1956 but were not computed for any category including fewer than 25 persons. The approximate rate of median salary increase in the two-year period is shown in Table II. It would appear from these data that while median salaries paid in Federal service are relatively high by comparison with other employers, the rate of salary increase at each level during this two-year period was among the lowest. This is represented graphically by Table III.

Table IV presents still another picture of biologists. The median salary of a biologist with limited experience employed by the Federal Government is higher than average. On the other hand, it is important to note that several other types of

Table I

DISTRIBUTION OF BIOLOGISTS BY TYPE OF EMPLOYER

	1954	1956
B.S.		
College	401	227
High School	137	128
International Government	3	0
Federal Government	2,022	1,503
State Government	793	790
Non-Profit Organization	65	53
Self-Employed	182	141
Industry	1,241	1,363
Miscellaneous	0	31
Total	4,844	4,236
M.S.		
College	1,688	1,055
High School	287	272
International Government	1	0
Federal Government	1,219	958
State Government	562	506
Non-Profit Organization	129	93
Self-Employed	79	66
Industry	662	601
Miscellaneous	0	52
Total	4,627	3,603
Ph.D.		
College	4,272	4,534
High School	14	59
International Government	9	0
Federal Government	968	897
State Government	250	161
Non-Profit Organization	216	216
Self-Employed	23	30
Industry	405	524
Miscellaneous	0	80
Total	6,157	6,481
TOTAL	15,628	14,320

Table II

MEDIAN ANNUAL SALARY BY TYPE OF EMPLOYER

	1954	1956	Increase
B.S.			
College	$5,550	$ 6,230	12%
High School	4,350	4,900	12%
Federal Government	5,930	6,390	08%
State Government	4,760	5,440	15%
Non-Profit	5,760	7,310	27%
Industry	5,760	6,750	18%
Self-Employed	7,500	8,250	....
M.S.			
College	$4,890	$ 5,900	20%
High School	4,790	5,480	14%
Federal Government	5,860	6,560	12%
State Government	4,700	5,560	18%
Non-Profit	5,680	6,870	21%
Industry	6,260	7,280	16%
Self-Employed	7,160	8,500	....
Ph.D.			
College	$6,400	$ 7,160	12%
High School	*	6,970	....
Federal Government	7,320	7,660	05%
State Government	6,210	7,040	13%
Non-Profit	7,420	7,930	07%
Industry	8,470	9,390	10%
Self-Employed	*	12,000	....

* Too few cases to permit calculation of median

employers offer higher median salaries for biologists who have attained greater experience in the field, regardless of level of education.

With respect to numbers of persons employed, the Federal Government, colleges and universities, and industry are the major employers of biologists included in this study. Table V lists median salaries paid by these employers to specialists in various fields of biology at different levels.

The study was sent to the Civil Service Commission in May of 1958. An informational hearing was held by the CSC shortly thereafter and the results of the study were presented to the various agencies of the Federal Government hiring biologists.

Before requests from these agencies for a salary increase for several of the specialty categories could be acted upon, Congress passed and the President signed a bill granting a 10 percent increase to all Federal employees. The future of additional salary increases for biologists, to bring them to the level of other Federally-employed scientists, is uncertain.

Table III

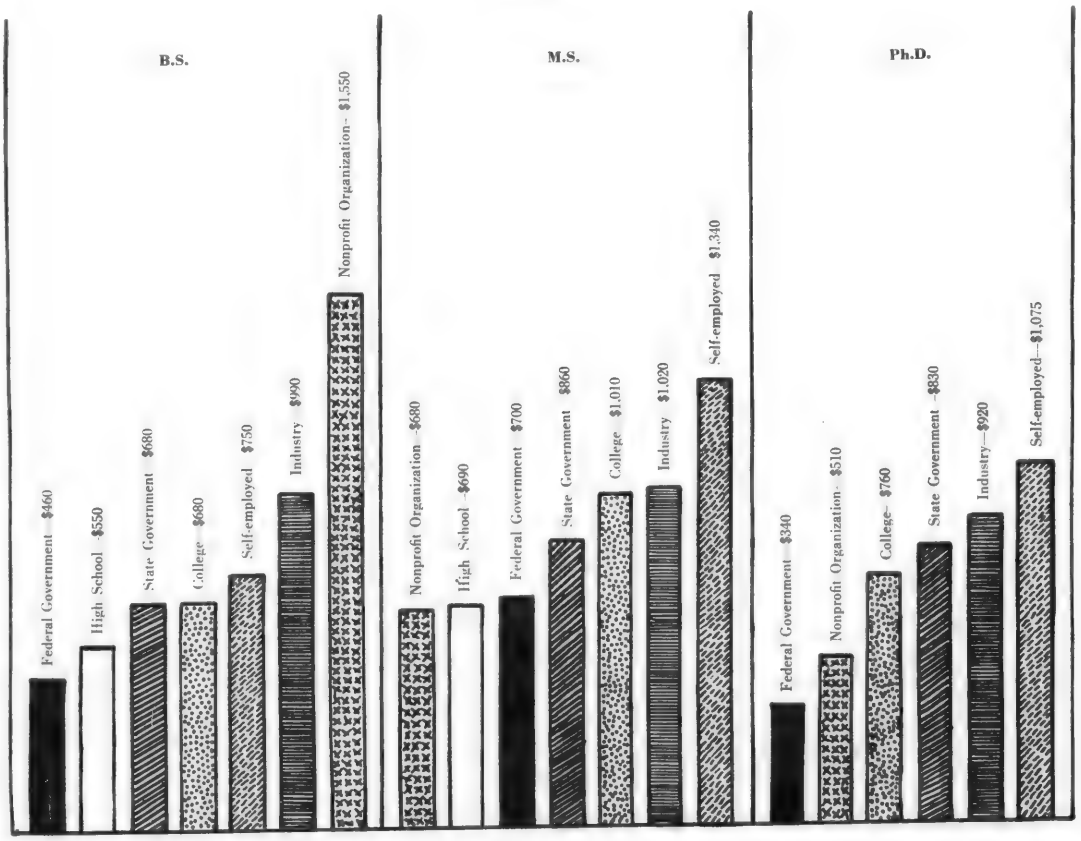

Table IV

MEDIAN ANNUAL SALARY BY YEARS OF EXPERIENCE—1956 ONLY

	Under 2 Yrs.	2-3 Yrs.	4-7 Yrs.	8-14 Yrs.	15-over Yrs.
B.S.					
College	*	*	$5,420	$5,960	$ 7,500
High School	*	*	4,760	4,940	5,600
Federal Government	*	$4,180	5,100	6,010	7,630
State Government	*	4,560	5,040	5,580	6,770
Non-Profit	*	*	*	*	8,250
Industry	*	5,120	5,820	7,240	9,280
Self-Employed	*	*	6,830	8,420	9,500
M.S.					
College	*	$4,880	$5,180	$5,960	$ 6,350
High School	*	*	5,120	5,460	6,290
Federal Government	$4,880	5,040	5,300	6,320	8,040
State Government	*	4,920	5,140	5,820	6,800
Non-Profit	*	*	5,400	7,500	8,500
Industry	*	5,300	6,550	7,740	9,430
Self-Employed	*	*	*	*	9,750
Ph.D.					
College	$5,200	$5,560	$6,250	$7,100	$ 8,570
High School	*	*	*	*	8,500
Federal Government	*	5,440	6,370	7,350	8,950
State Government	*	*	6,030	7,290	8,110
Non-Profit	*	*	6,570	7,860	10,660
Industry	*	7,500	8,340	9,780	11,940
Self-Employed	*	*	*	*	*

* Too few cases to permit calculation of median

Table V

MEDIAN ANNUAL SALARY BY LEVEL OF ACADEMIC DEGREE EARNED—1956 ONLY

	B.S.	M.S.	Ph.D.
College			
Agriculture	$6,750	$6,680	$ 7,860
Agronomy	*	*	7,750
Biometry	*	*	7,900
Botany	*	4,920	6,650
Ecology	*	*	6,870
Entomology	*	6,000	7,460
Forestry	5,860	6,460	7,690
Genetics	*	*	7,380
Horticulture	6,750	6,360	7,400
Microbiology	*	*	7,000
Parasitology	*	*	6,800
Taxonomy	*	*	6,720
Zoology	*	5,060	6,500
Biology	*	5,100	6,340
Biochemistry	*	*	7,450
Federal Government			
Agriculture	$6,960	$6,680	$ 7,550
Agronomy	6,280	6,650	7,720
Botany	*	*	6,900
Ecology	6,000	6,500	7,550
Entomology	6,960	6,870	7,650
Forestry	6,250	6,390	7,900
Genetics	*	*	6,870
Horticulture	*	*	8,400
Parasitology	*	*	8,160
Zoology	5,680	6,000	8,080
Biology	6,670	6,080	8,000
Plant Pathology	*	*	7,100
Plant Physiology	*	*	6,830
Industry			
Agriculture	$7,960	$7,690	$10,180
Agronomy	8,100	7,370	9,250
Botany	*	*	8,370
Entomology	7,130	7,570	9,780
Forestry	6,460	6,610	*
Horticulture	8,300	7,500	*
Microbiology	*	*	9,830
Biochemistry	*	*	8,830
Plant Pathology	*	*	9,250

* Too few cases to permit calculation of median

Biology in Germany Today

A. GLENN RICHARDS, *University of Minnesota, St. Paul*

I. The training of biologists

THE official German Research Organization recently issued a 72-page booklet entitled, "Memorandum on the Status of Biology"* based on data collected between November 1956 and July 1957. This was prepared by Dr. A. H. Meyl with advice from a committee of 15 professors and directors of institutes. The content and treatment indicates that it is intended for the use of university rectors, of the Ministries of Culture and Education of the various States, and of industrialists and economists.

The Introduction points out that Germany lost its preeminent position in biology after World War I. Now, for training in the newer fields of the past twenty years (modern genetics, microbiology, virology, etc.) young men must be sent abroad—and many of them do not return because there are not enough institutions with appropriate facilities and acceptable positions. Even the traditional fields are being continually depleted by the emigration of trained personnel. The Memorandum, then, addresses itself to the question of what can be done to improve the situation.

First, there is an analysis of the status of the various fields of biology under the headings: Morphology and Systematics, Ecology, Physiology, Genetics, Microbiology, Biochemistry, Biophysics, and Biomathematics. Throughout this treatment the foremost idea is that, while traditional biology must be continued and jobs somehow found for the 'old fashioned' types of biologists, what is really needed are 'modern biologists' fluent in chemistry, physics and mathematics, capable of using newer equipment and methods, and ready to attack 'important problems,' that is, problems which require such background and equipment. Actually, this is the most interesting part of the pamphlet, and, except for the occasional references to the situation in Germany, could apply to the status of biology throughout the world. There is obvious bias, but in spite of this bias the treatment is comprehensive and good.

In the next section it is pointed out that the number of students majoring in biology in the universities and technical colleges of Germany rose from 950 in 1934/35 to 3201 in 1949/50 but has been slowly decreasing since then. It fell to a low of 1973 in 1955/56, and rose to 2280 the next year. In percentage of the total student body, majors in biology rose from 1.2% in 1934 to 3.2% in 1949, and has now dropped back to 1.8%. The Memorandum says that this stagnation is no doubt due to the poor job prospects for biologists in industry. Whether this is true or not, the tabular data show that biology ranks sixteenth among the various curricula—a low status when we remember that this includes not only botany and zoology but also the non-medical applied aspects of both.

Students majoring in biology in Germany may be preparing for any of three careers. They may be taking a doctorate with thesis and heading for eventual "Promotion" which allows them to lecture at a university. Or they may prepare for the "State's Examination" which permits them to teach in what we would call high schools (in Germany, as in America, most university professors do not have the credentials for teaching in secondary schools). Or they may seek a "Diploma," a more technical or applied degree needed by persons wanting professional employment in industry or government.

Confining our attention to what is said relative to university and institute positions, we find a rather amazing set of statements. The Memorandum states that considerable difficulty is encountered about replacements despite the large number of graduates in biology. It says that the trouble stems from four things. First, there is a surplus of (undesired) graduates with traditional training; second, a dearth of (desirable) graduates with 'modern' training; third, an inadequate total number of positions; and fourth, a lamentable, albeit natural, tendency of many institute directors to recommend for tenure positions persons of dubious or borderline status (simply because such persons have no future at all if dismissed). The Memorandum goes on to say that improvement can come only when there is an increase in the number of chairs and institutes coupled with a simultaneous 'modernization' of the training program. To be sure, such would be one solution—a solution that retains all the essence of the germanic academic structure where the *Professor* has total authority, and all others are aspirants, or failures relegated to *Assistent* status, or failures to be disposed of. Nowhere in the Memorandum is there any suggestion that the academic structure itself might profitably be modified, that positions below that of *Professor* might be made desirable in the sense of security and providing a 'good life.'

There are relatively few positions in the U. S. corresponding to that of a *Professor* in Germany. It is not necessarily equivalent to our department head though in certain cases near to it. The *Professor* truly has total authority over his group. Arrogance and the use of dictatorial power are noticably prevalent. While there are indubitably exceptions, and the power is certainly not always abused, the potential of the position is always present. I personally see little liklihood of change in so deep-seated an organization when it is accepted by the general population. And with no change in the organization, I see little hope for improvement in the overall situation simply by increasing the number of professorships and institutes.

The Memorandum continues with a treatment of the current personnel and equipment situation. It says the *Professors* are overworked. And they certainly are. The *Professor* is expected to deliver the main general lecture of his division (for which he receives lecture fees from the students to augment his salary) and to direct literally everything else personally. Astonishing to an American is the statement that there is "a seemingly endless increase in the number of non-delegatable duties" such as lectures, congresses, editorships, expert counsel, etc. To us, most of these are not "non-delegatable." The Memorandum says that this can be corrected only by an increase in the number of chairs. Americans may think of other ways—ways that obviously are attractive to considerable numbers of young German graduates.

Zoological and Botanical Institutes are located in about twenty cities of West Germany. These provide, since some have more than one Institute (e.g., Tübingen has Institutes for zoology, zoophysiology, botany, applied botany, and four Max Planck Institutes), 33 professorships in botany, 23 in zoology, 7 in special schools, and 14 in Max Planck Institutes, a total of only 77 for all of West Germany. Unquestionably more are needed, and a considerable amount of factual data on the subject is given. It is summed up in the Memorandum in the suggestion that the number of positions and the amount of money for equipment and operating expenses needs to be more than doubled immediately. Whether German economy can afford this or not is left unanswered.

In the last section of the Memorandum a change in the training of biologists is proposed. This is to make the first three of the usual six college years common for all biology majors so that at the half-way point, instead of at the outset, a student can decide whether he wants to be candidate for the degree which leads to a university career or to high school teaching or to applied biology. Strong arguments in favor of this are presented. The proposal seems

* Actual title: "Denkschrift zur Lage der Biologie." Published by the Deutsche Forschungsgemeinschaft, Frankengraben 40, Bad Godesberg, Germany, February 1958.

desirable—and attainable. Less forcefully it is also suggested that it might be profitable to make it easier for a university *Assistent* to change over to a high school teaching career, and even for a high school teacher to shift over to being a university *Assistent*. There are, then, several concrete proposals for improving the present system.

The Memorandum ends with six appendices listing the institutes which supplied data, examination schemes, sample examinations for teachers, and two different curricula suggested to replace existing ones in order to modernize the training of biologists (one of these impresses me as having good balance, the other minimizes biology in favor of math, physics and chemistry). In fact, the whole Memorandum is packed with information, and it should be of interest to all who are curious about German biology.

II. The Max Planck Institutes

Before World War II, the research institutes of the Kaiser-Wilhelm Society at Berlin-Dahlem were internationally famous. Toward the end of the war most of these institutes were moved to temporary quarters in Hechingen in SW Germany. After the war, return to Berlin-Dahlem was not feasible, and the various Institutes moved individually to places where they could develop or best renew their activities. These Institutes, now comprising the *Max Planck Gesellschaft zur Förderung der Wissenschaften* or Max Planck Society, have no central location but are scattered all over West Germany. This, and the annual changes, leads to considerable confusion outside of Germany. Many Americans do not realize that there is not one Max Planck Institute but many (actually about 35) and that these are widely scattered.

It is not easy for a visitor—as I was during 1957/58 at the M.P.I. for Biology at Tübingen—to obtain a clear picture of the organization. No complete history has been written. Numerous chapters for such a history are to be found in old issues of the Society's News Bulletin, and some information on more recent events can be dug out of the Yearbooks of the M.P. Society. It helps to converse with persons who have lived through the vicissitudes of the organization, and I had the great advantage of discussions with Prof. Dr. A. Kühn, Director of the M.P.I. for Biology, and others of this group.

We are so accustomed to European institutions stating their age in terms of centuries that it comes as something of a shock to find that the parent organization, the K.-W. Society, was founded less than 50 years ago. The history of the K.-W. Society begins with a memorandum in 1909. This was followed by approval and allotment of land in Berlin-Dahlem in 1910, and the building of the first Institute in 1912. Support came primarily from the German chemical industry—and the first Institute built was, appropriately, the Institute of Chemistry. The Institute of Biology was established in 1914 under the direction of the geneticist Correns, and has since had associated with it as directors Spemann, Wettstein, Goldschmidt, Hartman, Kühn and Melchers (the last named being the current director).

The M.P.I.s are simply the now scattered components of the former K.-W.I.s. This is explicitly stated in the 1953 Yearbook. Freely translated: "He (Otto Hahn) is, after Adolph von Harnach, Max Planck, Carl Bosch and Albert Vögler, the fifth of our Presidents, but the first in the new division of our history which began in 1945/46 and which differs in no manner except for the change of name in 1948." What these Yearbooks term the 'liquidation of the K.-W. Society' was "made necessary by regulations of the Allies." Complicated legal questions were involved, and negotiations settling these extended over nearly ten years, that is, for some years after the K.-W. Society was officially dissolved in 1951 and its remaining powers passed over to the M. P. Society which had been officially founded in 1948.

The M. P. Society consists of a President (Otto Hahn has been President since the founding), two Vice-Presidents, a Senate, a Governing Board, and a Scientific Council. As in all organizations the General Secretary is a most important person. The Senate has an unspecified number of members, some 30-40, of which about half are Professors and Directors of M.P.I.s, one-third representatives from industry and business, and the remainder representatives from State and Federal governments. The Governing Board consists of the President, the two Vice-Presidents (one a scientist, the other a banker), and four Senate members. Various committees function throughout the year. An annual meeting is held in the spring, and a Yearbook and Quarterly News Bulletin are published. The journal *Die Naturwissenschaften* lists itself as an organ of the M. P. Society and another society but it is not directly supervised or published by these societies. Central offices are in Göttingen, but to a large extent the individual institutes function autonomously with the institute directors having full administrative authority for their groups.

Repeatedly in the Yearbooks one finds statements such as, "What differentiates us primarily from other scientific institutions, both domestic and foreign, is the complete freedom of investigators in our institutes." Since I have never experienced anything other than complete freedom in my research in the several American universities with which I have been associated, I am not inclined to consider this point a distinctive feature found only in the M.P. organization. More distinctive, it seems to me, is the fluidity of organization within the M. P. Society. Each Yearbook tells of the founding of new institutes (commonly by the elevation of a previous *Abteilung* to independent status), the discontinuation of some, and other major changes—the most radical in recent years being the complete transfer of the M.P.I. for Biochemistry from Tübingen to Munich. In effect, the University of Munich and the State of Bavaria promised Prof. Dr. Butenandt such excellent financial backing, new buildings etc., that he persuaded the Society to approve his moving the Institute. In America, individuals change positions for these same reasons, and sometimes can arrange to take their research teams with them, but the bodily transport of the organization and its very name is not something for which individual directors barter. Likewise, a change of directors can revolutionize a M. P. I. because the Institutes are really organized as so many private "kingdoms" for the individuals who have been appointed directors. For instance, the *Abteilung Kühn* and its predecessor in the K.-W. Society have been internationally famous for many years for genetical and developmental physiology. Now with the retirement of Prof. Dr. Kühn most of the personnel are leaving. Some of the replacements are cyberneticists (a new subsection); the one who is slated to become director is a cytologist—he will re-staff the laboratory as he sees fit. Physiological genetics will be continued at least for a while by Prof. Dr. Kühn who will retain one portion of the building. All such things can happen in America, but only rarely do they happen. Truly the fluidity or changability (some Germans call it adaptability, others call it unpredictability) within the M. P. Society is a most striking feature to one from America.

The possibility for such great changes is implicit in the boast of the M. P. Society that, like its predecessor the K.-W. Soc., it has a double freedom: freedom from orders from its money givers (both private and official) and freedom to do whatever scientific work it wishes, and for the individual directors within the bounds of their buildings to use their resources as they see fit. To quote, "We are responsible only onto ourselves." The M. P. Society selects its own members, especially institute directors, decides on founding, changing or closing institutes and divisions thereof, and on the methods to be used in furtherance of the organization. But they still have to obtain their unobligated funds. And to quote again, "It is not always easy to convince the Cultural and Financial Ministers of the States of the individuality, the separate support, and the significance of our institutes."

The M. P. Institutes of interest to biologists include: *Biology* (Biologie), with sections *Kühn, Melchers* and *Weidel* (Tübingen), *Hydrobiology* (Hydrobiologische) (Plön/Holstein), *"Meeresbiologie"* (several places), *Bird Migration* (Vogelwarte Rodolfzell) (Schloss Möggingen), *Cell Physiology* (Zellforschung) (Berlin-Dahlem), *Behavioral Physiology* (Verhaltensphysiologie) (near Munich), *Animal Breeding and Nutrition* (Tierzucht und Tierenahrung) (Mariansee), *Plant Cultivation* (Züchtungsforschung), (Gut Voldagsen), *Virus Studies* (Virusforschung) (Tübingen), *Biochemistry* (Biochemie) (Munich) and *Biophysics* (Biophysik) (Frankfort). There are also medical insti-

tutes (especially at Heidelberg) which include divisions for cell chemistry, physiology, etc., and applied physiological institutes such as the one for *Human Work Physiology* (Arbeitsphysiologie) (Dortmund) and the one for *Fiber Research* (Bastfaserforschung) (Westfahlen) which includes plant anatomy and commercial cultivation sections. Most of the other institutes are of no interest to biologists (iron, coal, silicates, physics, etc.). Some of these institutes have a continuous history of nearly fifty years, except for change of name; others are new or now undergoing changes. One hears that there are strong pressures to create more and more small units in various other cities.

No photographs are included here because there is no such thing as a main or principal set of buildings, or even a typical building. Hundreds of buildings are involved. Some are new and modern laboratories, some are renovated houses, some are in university buildings, and some are or have been in old castles. One common European feature seldom seen in America is the incorporation of living quarters into many of these buildings. Some of the staff live in these quarters, and visitors may also be temporarily accommodated. Frequently the Director is supplied with a separate house for his residence.

Members of the M. P. Society numbered 630 in 1952, increasing to 830 in 1955 (580 permanent, 250 one-year appointments). But these figures tell little because they include only a portion of the staff of each institute and include many Society members who are not in any institute. The actual number of scientific workers in the various institutes is recorded as totaling about 2050 in 1955.

In the years immediately following the last war, the Society (then still the K.-W. Soc.) was saved financially by the generous contribution of many millions of DM from German industry plus a variety of temporary housing arrangements. Some millions of dollars were later obtained from Marshall Plan funds (on one of the Institutes in Tübingen is a tablet reading *"Hier hilft der Marshallplan"*). For the fiscal year 1951/52 the money available was listed as 3¼ million dollars; the next year it became 3½ million; the next 4¾ million; and the next year about 7 million. In 1957/58 funds were almost 10 million dollars. But these sums cannot be evaluated in terms of American budgets because salaries are relatively low in Germany. Also, considerably more than the above sums are actually spent because individual institutes and members thereof can apply for additional funds from agencies such as the *Deutsche Forschungsgemeinschaft* (German Research Society, primarily a fund-granting agency), the W. H. O., etc. Numerous technicians are paid from such outside sources and not included in the Society's budgetary statements. Resources of some of the Institutes are further augmented by association with a university (for instance, Butenandt is both Director of the M. P. I. for Biochemistry and Head of the Department of Physiological Chemistry of the University of Munich), but it is probably generally true that the university derives more benefit from such association than the institute does.

In the former K.-W. Society it is reported that about 50% of the funds came from private sources, mostly industry. The present M. P. Society obtains 75-80% or more of its funds from governmental sources (what we would call Federal and State funds). Since governmental funds are said to be inadequate for the needs of the Society, private funds in larger amounts are continually being sought.

Frequently in news analyses and discussions of the world situation one encounters reference to the amazing postwar recovery of West Germany. Equally amazing, it seems to me, is the preservation of so much of the caliber and ideals of the former K.-W. Institutes in what is today called the M. P. Society. It is only to be hoped, however, that ways may be found to deter the continuing exodus of so many of the best young German scientists to other countries. It does not seem likely that this can be accomplished without reorganization which would make the average position for a competent biologist in Germany as good as elsewhere—at present only the relatively few directorships are really secure and satisfying positions.

New Journal in Microform

CARLTON M. HERMAN*, *Patuxent Research Refuge, Patuxent, Md.*

THE Wildlife Disease Association is venturing into an experiment to publish original scientific data in microform. Although many scientific publications have been reproduced in this medium and several periodicals are available in microform as well as regular macroprint editions, this is the first attempt to publish a serial in microform exclusively. The new serial, to be named *Wildlife Disease*, will start publication in January, 1959.

The Wildlife Disease Association

In March, 1951, at the annual meeting of the North American Wildlife Conference, a group of American and Canadian scientists, representing state and federal conservation agencies, the U.S. Public Health Service, universities, and others, met to discuss their common interests and problems in studying wildlife diseases. The result was the formation of the "Committee on Wildlife Diseases." In 1952, the name of this group was changed to "The Wildlife Disease Association." Since then the organization has met annually in an all-day informal session in conjunction with the North American Wildlife Conferences.

Communication among the members regarding new developments in the field, and exchanges of information and news have been facilitated by the periodic issuance of Newsletters by the Chairman. Dr. Carlton M. Herman, of the U. S. Fish and Wildlife Service, has been chairman of the Association since its inception and Dr. David E. Davis, of Johns Hopkins University School of Hygiene and Public Health, is vice-chairman.

The purpose of The Wildlife Disease Association is to increase interest in and knowledge of wildlife diseases. The organization is concerned with the parasites, diseases, physiology and other factors related to health and survival of wild animals, including those in captivity, their effects upon wild populations, and their direct and indirect relationships to man.

The membership of the Association has grown steadily and now is approaching 300. It includes representation from all fields of conservation, from public health, from all concerned agencies of government, from many educational institutions, and from diverse professional occupations throughout the world.

Early in the existence of this organization there were discussions concerning the need and advisability of publishing a journal within the scope of interest of the Association. In 1955 a journal committee consisting of John J. Christian, Naval Medical Research Institute, Chairman; Charlie N. Barron, Armed Forces Institute of Pathology; A. Murray Fallis, Ontario Research Foundation; William L. Jellison, U. S. Public Health Service; and, Herbert L. Ratcliffe, Philadelphia Zoological Society, reviewed this problem and recommended the matter be tabled as untenable for the present. The chief reasons for this conclusion were the current small membership and prohibitive costs involved

* Editor, *Wildlife Disease.*

in publication if high standards were to be maintained. It was felt that dues would have to be increased beyond reason to meet costs. One of the aims of this organization is to keep dues at a low figure to entice all interested investigators into membership. Currently dues are only $1.00 per year.

Publication on Microcards

At the Conference of Biological Editors in New Orleans in April, 1957, it was recommended "that groups of biologists planning to establish a new journal be urged to undertake . . . a pilot project utilizing some form of new medium such as macroform in brief coupled with micropublication in detail" (*AIBS Bulletin*; 7(3); 22, June, 1957). Subsequently, the matter was discussed with Dr. Hiden T. Cox, Executive Director of the AIBS. After much correspondence among a number of the members, particularly with the original journal committee which was brought back into action, the matter was put before the members of the Association at the annual meeting in March, 1958. Sanction was given to the proposal that our Association draft and submit grant applications, through the AIBS, which would permit activation of a publication project on an experimental basis with no additional assessment of dues.

Funds have been allocated through two grants, one from the Council on Library Resources, Inc., the other from the National Science Foundation, each covering approximately half the amount needed to conduct the project for a three-year period. These funds provide for the hiring of a part-time secretary and necessary office equipment to handle the business activities of the project which will be housed at the AIBS headquarters in Washington, D. C. It also provides for publishing a total of 48 Microcard issues, or 16 per year, for the three-year period, plus a quarterly macroprint leaflet of abstracts of the papers printed on the Microcards. In addition, through arrangements between AIBS, the Council on Library Resources, Inc., and the Microcard Corporation, 220 hand Microcard readers will be supplied to those who were active members at the time the grant proposals were submitted, and as long as they last to our newer members, for a minor cost of $2.25 each, including charges for mailing, handling and insurance. The additional costs for obtaining these readers will be covered by the grant. This is a newly developed reader that we feel is superior to any that have been on the market thus far. Further, arrangements have been made to provide an additional segment of future members the opportunity to purchase these readers at a substantial reduction from retail list price. Final figures are not available as yet, but it is estimated that the costs of these readers to subscribers during the experimental period will be under $10.

We are entering this project on an experimental basis. This is the first scientific periodical to be published with original copy exclusively in microprint. However, many journals, such as *Science*, are available now in Microcard editions in addition to their regular macroprint editions. An increasing number of journals, both foreign and domestic, are becoming available in reprint in microprint editions, either on microfilm of one sort or another or on positive Microcards. Many rare books also are being reproduced in these media. The growth of this publishing field undoubtedly will further increase the demand for better optics and for recognition and status of original issues such as our effort.

Many peripheral activities will be in progress during the three years of our grant support which will have direct or indirect bearing on our experiment. There is already increased activity toward development of better and less costly readers. We will be experimenting with factors of magnification, page size and medium concurrent with development of improved optics.

The Microcards are durable 3" x 5" white cards with positive micro-opaque reproduction of manuscript material. Maximum return will be obtained from manuscripts with 47 pages, the number that can be printed on one Microcard. Preliminary policy will be to have only one paper on a card; but, if shorter manuscripts are accepted for publication, there may be some experimentation with more than one article per card. No limitation will be placed on length of papers so that some articles may require two or more cards. While four Microcards are planned for each quarterly issue, this will not be considered mandatory. Material will be published as it is received to shorten the interim between submission of manuscript and publication date. This has long been a "bugaboo" with many scientific journals and the methods that can be employed with this new medium should contribute to solving this problem. Thus, some issues may be only one or two Microcards; others may run well over four. As soon as manuscript material can be edited and processed it will be published in the next quarterly issue.

The editorial challenge to types of material adaptable to new considerations by this medium are fascinating and revolutionary. Dictations of length have already been pointed out. There will be no limitations on use of tables and illustrative material since such items require no additional charges for special typesetting or engraving plates. The only criterion for inclusion of such material will be that it be pertinent to the text or presentation. After the limitations forced on editors of most regular print journals, it will be quite an experience for an author to receive a note from an editor advising use of more tables and illustrations. Further, there is no limitation to the size of tables or charts. Where a tabulation would require a big area in a standard publication such that a tipped-in folded sheet would be necessary, it is discouraged because of excess labor costs involved. While many tables are better reduced to small size with only limited data pertinent to a single or only a few points of interest, there are often extensive tables that can more adequately express an author's full premise if space can be provided for their inclusion in a publication. Much experimentation is anticipated with presentation of such illustrative tables, charts and illustrations that require multiple page space.

No galley proof will be sent to an author. The manuscript submitted by the author will be retyped, single spaced, on an electric typewriter. A carbon copy will be sent to the author to point out any typographical errors, etc., corrections then being made on the finished copy before photographing.

Retrieval

Concurrent with each quarterly issue of the journal on Microcards, a leaflet will be processed containing abstracts of the microprint material. This leaflet, printed in regular size print, will accompany the cards sent to all subscribers and also will be circulated to *Biological Abstracts* and other abstracting services so that the titles can be brought to the attention of non-member biologists.

Each Microcard will contain a running head in regular size print that will include date and issue number, author and title. Since each article will be an entity unto itself, the cards can be filed in sequence as is necessitated in regular journal publication, or they can be filed by subject, author, or other classification.

The master copy of the Microcard will provide continued availability of the published articles at approximately the original cost. Authors underestimating their requirements for reprints can always obtain more Microcard copies of their articles. Future biologists will never find any issue out of print. Besides assuring retained availability, this factor also provides considerable saving to the publishing society. Because of this retained availability, it will not be necessary to obtain an initial over run to meet future demands. This is a saving not only in initial printing costs but also avoids the necessity of storage space for back issues. Each card will contain a specific catalog code number by which the printer, Microcard Corporation, can retrieve the negative for preparation of additional cards exactly as the original.

At least a portion of a page on the Microcard will be devoted to retrieval aids. Experiments will be conducted to test the usability of key words that will classify the main contents of the article. This is an innovation for inclusion, at publication, with biological articles. As part of the grant requirements experiments will be conducted to develop methods of library retrieval to insure maximum usability and recovery. Foster E. Mohrhardt, Director of the U. S. Department of Agriculture Library, is serving as consultant on such matters.

Membership in The Wildlife Disease Association is open to all interested sci

entists. Current dues of $1.00 per year should be submitted to Dr. A. B. Cowan, Treasurer, Wildlife Disease Association, School of Natural Resources, University of Michigan, Ann Arbor, Michigan. All members will receive the Association's Newsletter, the Microcard publication *Wildlife Disease*, and have the other privileges of active membership.

Xth International Congress of Genetics*

THE Xth International Congress of Genetics was held at McGill University, August 20–27, 1958, under the sponsorship of the Genetics Society of America and the following co-sponsors: Agricultural Institute of Canada, American Cancer Society, American Eugenics Society, American Genetic Association, American Society of Agronomy, American Society for Animal Production, American Society for Horticultural Science, American Society of Human Genetics, American Society of Naturalists and Society for the Study of Evolution. The President of the Congress was Professor Sewall Wright. Professors C. Barigozzi, A. Müntzing, C. Pavan, L. S. Penrose, Y. Sinotô, A. H. Sturtevant and W. P. Thompson were Vice-Presidents. Professor J. W. Boyes served as General Secretary.

The total membership of 1,672 greatly exceeded the 863 of the previous Congress and consisted of representatives from 50 countries. Twenty countries were represented by 58 official delegates who included representatives of sixteen overseas universities.

The program began with an Inaugural Session featuring addresses of welcome by various government representatives in Canada, a report by Professor C. Barigozzi for the Permanent International Committee for Genetics Congresses, and an address by President Sewall Wright on *The Place of Genetics in Science*. Honorary Degrees of Doctor of Science were conferred upon Hitoshi Kihara, Lionel S. Penrose and Curt Stern by McGill University, and upon Theodosius Dobzhansky and Conrad H. Waddington by the University of Montreal. The scientific program consisted of 33 reports in seven Symposia, 543 Contributed Papers in 43 sessions, three Public Lectures, a session of 40 Demonstrations and a Panel Discussion on *The Teaching of Genetics*. A special feature of the Congress was an extensive Exhibit illustrating the topic *Genetics in the Service of Man*. Social events included an official reception by McGill University, a Civic Reception by the City of Montreal followed by a Chamber Music Concert at McGill, two Vin d'Honneur receptions at the University of Montreal, a Chicken Barbecue at Macdonald College, and a final Smoker.

Tours were organized to the Montreal Botanic Garden, Ottawa, Quebec City, the St. Lawrence Seaway, Niagara Falls and Genetics Laboratories of the Eastern United States. Nearly 400 persons (84% from overseas) participated in these tours. Two information booklets, plus other miscellaneous items, and a brochure entitled *Exhibits, Genetics in the Service of Man*, were published before the Congress. The Proceedings, consisting of *The Programme* (71 pages) and *Volume II: Abstracts* (339 pages, 576 abstracts) both of which were available at registration, and *Volume I* which will contain the full texts of the Presidential Address, Invitation Papers and Public Lectures, and records of Business Meetings, etc., will be published about April, 1959. These Proceedings can be ordered from the University of Toronto Press, Toronto, Ontario, Canada.

The Final Business Meeting of the Congress received a report by Professor I. M. Lerner from the Permanent International Committee for Genetics Congresses (Genetic Section of the International Union of Biological Sciences). The following resolution was included in the Committee's report:

"The Permanent International Committee on Genetics Congresses considers it to be its duty to express deep concern over the fact that a number of Soviet geneticists who had submitted abstracts of papers to the Xth International Congress of Genetics failed to appear in Montreal. The Committee also deeply regrets the absence of representatives from a number of other countries. It wishes to express its deepest sympathy and send its warmest regards to all scientists who may have been prevented from attending the Congress by their Governments.

"The IXth International Congress of Genetics, meeting in Bellagio in 1953, passed a resolution that Genetics Congresses should not 'be held in any country to which it may be expected that scientists would be refused permission to enter on grounds of race, nationality, religion, place of birth or political associations past or present.' The permanent Committee takes this occasion to extend this policy by appealing strongly to all governments in the the world to allow their scientists the right of unimpeded travel for scientific purposes, without regard to race, nationality, religion, place of birth, past or present political associations and, in view of the experiences at the current Congress, irrespective of whether their scientific views and work are in conformity with any official governmentally-shaped policies and idealogy. We consider any attempt on the part of governments to interfere on political, ideological or other grounds with the free pursuit of science and free dissemination of scientific information as a serious violation of the basic principles of research. We appeal to the learned academies and scientific societies of all countries and to the United Nations and its organizations to exert all possible influence to persuade all governments to adhere to the principles outlined here. Their violation will, no doubt, spell the end of scientific freedom and therefore also of scientific progress."

The following resolution, submitted by the Genetics Society of America was approved with the full support of the delegation from the U.S.S.R.:

"The Tenth International Congress of Genetics views with concern the increasing levels of radiation from medical, industrial and military sources to which human populations are being subjected. All such irradiation acts genetically to the detriment of this and future generations.

"We call the attention of all appropriate authorities to this serious and developing situation and we urge that every attempt be made to reduce to a minimum these exposures and their ill effects by action at the international, national and individual levels. The Congress draws attention to the valuable Report of the United Nations Scientific Committee on the Effects of Atomic Radiation, and emphasizes the need for increased basic knowledge leading to a more comprehensive understanding and control of the damaging effects of radiation."

The Tenth International Congress was the largest ever held and truly international in scope; in both organization and consumation it was a joint operation of the geneticists of Canada and the United States. Its success is a tribute to the interest, cooperation and generosity of many persons in many countries and it was characterized by a warm feeling of friendly cooperation and by real progress in the science of genetics. We believe that it fulfilled the hope expressed by its President, Sewall Wright, that it would be "successful in strengthening our feeling of unity as well as in defining the current stage of development of our science."
J. W. Boyes

* Abridgement of Secretary's report.

1959 ANNUAL

A.I.B.S. MEETING

PENNSYLVANIA STATE UNIVERSITY

UNIVERSITY PARK, PA.

August 30–September 3

Across the Editor's Desk

• **The Department of State has announced the re-establishment of its overseas Science Officer Program** with the appointments of 7 distinguished scientists who will serve as Science Officers in the United States embassies in London, Paris, Rome, Bonn, Stockholm, and Tokyo. Although assigned to a specific embassy, the Science Officer will also provide scientific assistance in our embassies in adjacent areas. The men selected are: **Thomas H. Osgood**, Dean, School for Advanced Graduate Studies, Michigan State University, for London; **Edgar L. Piret**, Professor of Chemical Engineering, University of Minnesota, for Paris; **Edward H. Cox**, Retired Head of Department of Chemistry, Swarthmore College, as Deputy Science Officer for Paris; **Walter Ramberg**, Chief, Mechanics Division, National Bureau of Standards, for Rome; **Ludwig F. Audrieth**, Professor of Chemistry, University of Illinois, for Bonn; **Julin E. Mack**, Professor of Physics, University of Wisconsin, for Stockholm; and **Willis R. Boss**, Professor of Zoology, Syracuse University, for Tokyo.

These appointments, which will be for a period of two years, constitute the first of a series for the Science Program of the Department of State under Wallace R. Brode, Science Advisor to the Secretary. Still to be appointed are Science Officers for U.S.S.R., India, and South America, and Deputy Science Officers for all the posts with the exception of Paris to which Dr. Cox is being assigned. Leaders in science who have had experience as educators, research scientists, and administrators have been especially selected for these posts because of their international scientific reputation, and their knowledge of the status of science and acquaintance with scientists in the country of assignment. Each of the appointees also has a facility with the language of the country of assignment. The high standards set for the selection of these men have been maintained in these appointments. A Science Officer's primary role will be to serve as an Advisor to the Ambassador and his staff in the evaluation of the interaction of science with foreign policy, the assessment of current scientific progress abroad and the enhancement of the liaison between United States and foreign scientists and engineers. Physics, chemistry, engineering, and zoology are the disciplines represented in these initial appointments.

These appointments have been encouraged and urged by the scientific community both at home and abroad. Twenty-four countries which have scientific attaches in their embassies in Washington attest to the need and usefulness for representation of science in international affairs.

• **The American Academy of Arts and Sciences has announced the availability of grants** in aid of scientific research from several endowment funds held for this purpose by the Academy. Work in any field that may properly be called scientific is eligible for this support, including the mathematical and physical, the biological and the social sciences.

In general, individuals will be supported over organizations, although grants are permissible to public or private associations, societies or institutions. Special consideration will be given to projects on new frontiers of science, those which lie between or include two or more of the classical fields, and those proposed by investigators who may be on the threshold of investigational careers or are handicapped by inadequate resources and facilities. In general, the providing of assistance for laboratory or field observations will be considered more important than providing for bibliographic search, the preparation of manuscripts for publication, or other operations that are handled routinely in most institutions. The Committees do not ordinarily approve grants for research the results of which constitute partial fulfillment of requirements for an academic degree nor do they approve the purchase of nonexpendable equipment usually to be expected in an institutional laboratory.

Although grants-in-aid normally do not exceed $1,500, requests for substantially larger amounts for especially meritorious projects will be considered. Most grants range between $500 and $1,500. Applications must be filed in duplicate on forms obtainable on request from the Academy office, not later than *February 1* and *September 1*, and will be processed in order of receipt. Address communications to: Chairman, Committees on Research Funds, American Academy of Arts and Sciences, 280 Newton Street, Brookline 46, Mass.

• **The Foundation for Microbiology**, established in 1951 by Selman A. Waksman, is prepared to receive applications for grants in various fields of microbiology. The trustees of the Foundation have decided to give first consideration to applications dealing with problems of publication of monographs or large papers on microbiological subjects for which it is difficult to obtain financial support otherwise. Applications should be addressed to the Foundation for Microbiology, c/o Institute of Microbiology, Rutgers, The State University, New Brunswick, N. J.

• **The 1959–1960 Predoctoral Fellowship offered by Sigma Delta Epsilon,** graduate women's scientific fraternity, has been announced. This fellowship is awarded to women who give evidence of ability and promise in scientific research and who need financial assistance to further a well-defined project contributing to the Ph.D. or equivalent degree. Eligible candidates are matriculated graduate students in the physical, biological or mathematical sciences who during the fellowship tenure will be devoting more than half time to thesis or thesis research. The stipend is $1,600; applications are due *February 1, 1959*. Application forms may be secured from Dr. Geneva Sayre, Department of Biology, Russell Sage College, Troy, N. Y.

• **Beginning in 1959, the Society of American Foresters will establish a new serial publication to be known as *Forest Science Monographs*.** The Society provides an outlet for research results and for the expression of professional and scientific thought through its publications *Journal of Forestry* and *Forest Science*. The *Journal*, however, publishes relatively short papers only. *Forest Science*, although accepting somewhat longer papers, is unable to publish unusually long manuscripts even though of exceptional merit. *Forest Science Monographs* is intended to fill this need.

Papers of 32 printed pages or longer including tabular and graphic material (approximately 20,000 words or about 65 pages of double-spaced typescript) will be considered for publication in *Forest Science Monographs*. The same editor and advisory board will govern acceptance of papers as for *Forest Science*.

In undertaking this new publication to accommodate longer and more comprehensive articles, the Society must set up special financial arrangements. Each author (or his organization or sponsor) shall bear the entire cost of printing and mailing the *Monograph*. The Society will contribute editorial services, however, as it does for its other publications. *Forest Science Monographs* will be sent to all subscribers of *Forest Science* without extra charge. A small supply of *Monographs* will be stocked by the Society for sale. The author may, of course, order any number of additional copies. Charges for each *Monograph* will be on a negotiated basis in view of rapidly changing costs.

Inquiries about *Forest Science Monographs* should be addressed to the Society of American Foresters, 425 Mills Building, Washington 6, D. C.

• **The Statistics Department of the University of Wyoming and the Statistics Department and Statistical Laboratory of Iowa State College are jointly presenting an eight-week institute** for college and university teachers of statistics beginning June 15, 1959. The major objective is to provide supplementary training in statistics for present and prospective teachers of statistics in American colleges and universities. Basic courses will be offered in statistical methods, statistical theory, design and analysis of experiments, and design and analysis of surveys. Staff will include T. A. Bancroft, E. C. Bryant, H. O. Hartley, D. V. Huntsberger, Oscar Kempthorne, Robert F. White, Ed Deming, and others. The institute is sponsored by the National Science Foundation and will be held on the Laramie campus of the University of Wyoming. A stipend of $75 per week is provided plus a de-

pendent's allowance of $15 per week per dependent to a maximum of four. A travel allowance is also provided. Teachers of statistics in any department of subject matter field are eligible to attend, including persons who will be teaching statistics for the first time in 1959–1960. For applications and more detailed information write to Edward C. Bryant, Director, Summer Institute in Statistics, University of Wyoming, Laramie, Wyoming. Applications must be submitted by *February 16, 1959.*

• **The 14th International Congress of Limnology** will be held in Vienna, Austria, August 21 to September 2, 1959. The American Society of Limnology and Oceanography, Inc. has received a grant from the National Science Foundation to defray cost of coach-class air transportation for about twenty individuals who plan to attend. A committee of five, appointed by the President of ASLO, will receive and evaluate applications for these travel funds.

General considerations guiding the selection of applicants will include: (1) interest and activity in limnological research or applied limnology; (2) need for financial assistance in making the trip (those who can get this transportation paid otherwise should not apply); (3) receipt of applications by *March 16, 1959.*

Those selected will include younger scientists of promise as well as individuals with a longer history of research. Members and non-members of ASLO, residing in the United States and Canada, are eligible. Application forms and additional information about these funds may be obtained by writing the Secretary-Treasurer of ASLO, George H. Lauff, Department of Zoology, University of Michigan, Ann Arbor, Michigan.

• **A summer Institute for College Teachers of Biology, sponsored by the American Society of Zoologists and the University of Wisconsin,** will be held at the University of Wisconsin, June 22–August 1, 1959. The Institute, financed with a $45,000 grant from the National Science Foundation, will be designed to acquaint teachers of small colleges with the rapidly-advancing field of cell biology, providing particular emphasis on integration of cell biology, providing particular emphasis on integration of cell structure and function. Research in this field is usually conducted at larger institutions, and unless teachers are given special training such as this, it has become virtually impossible for them to keep abreast of advances in the field.

Enrollment in the institute is to be limited to about 40 college teachers. The course is to be an intensive one, although there will be no examinations and no academic credits earned. Most of the lecturers for the institute will be brought to Wisconsin from other outstanding institutions.

The institute directors will receive applications from any individuals who have been teaching biology at a small college. The 40 participants will be selected from the applicants and each provided with a stipend of $450 plus about $90 for each dependent up to a maximum of four dependents. A maximum of $80 for travel expenses will be available. There will be no tuition or fees. Rooms will be available for participants in the University of Wisconsin dormitories if desired.

Requests for application blanks and a brochure should be made to Prof. Harold R. Wolfe, Department of Zoology, Birge Hall, University of Wisconsin, Madison 6, Wisconsin.

• **The Tissue Culture Association is again sponsoring a course of instruction in the principles and techniques of cell and tissue culture.** The course will be under the direction of John Paul, University of Glasgow, Scotland, and will be given at the University of Colorado School of Medicine, Denver, Colorado, from July 6–July 31, 1959. The tuition will be $100. This is an intensive 4-week course dealing with the structure and function of living cells, techniques of tissue culture and interpretation of results. It is designed to give to responsible investigators a background of general information on cultured cells and an opening wedge of training in the application of the method to problems in several current areas of research. Because of limitations in laboratory space, only fifteen active participants will be accepted. These places will be allocated to those with no previous tissue culture experience who, in the committee's opinion, will derive benefit from the course. In addition, fifteen auditors will be accepted. Places as auditors will be allocated to senior applicants with predominantly administrative responsibilities and to those who have already had practical experience of tissue culture techniques but are likely to profit from the course.

The course is designed specifically for postgraduates (M.D. or Ph.D.) who plan to use cultured tissues in their research or teaching. Requests for application should be addressed to Dr. Mary S. Parshley, College of Physicians and Surgeons, 630 West 168th Street, New York 32, N.Y., and should be completed and returned to her not later than *April 1.* Successful candidates will be notified about April 15.

• **1959–1960 graduate research fellowships in the Carver Foundation, Tuskegee Institute, Alabama, have been announced.** Fellowships are offered for research and graduate study toward the Master of Science degrees in chemistry, foods and nutrition, and plant physiology. They are available to students with high scholastic records, who have received the Bachelor of Science degree from an accredited college and who show promise of research ability. Stipends range from $1,500 to $1,800 annually. Fellows normally devote half time to supervised research and half time to graduate study leading to the master's degree. It is generally expected that the requirements for the degree will be completed within two years. The stipends are intended to cover educational fees and living accommodations for one calendar year. Most of the fellowships will begin with the first semester (September, 1959).

Fellowship applications are acceptable immediately. Address requests for further information and application blanks to: The Director, The Carver Foundation, Box 188, Tuskegee Institute, Alabama.

• **The National Science Foundation has announced the award of 302 Science Faculty Fellowships** for the fiscal year 1959. These fellowships are offered as a means of improving the teaching of science, mathematics and engineering in American colleges and universities. The primary purpose of the awards is to provide an opportunity for college and university science teachers to enhance their effectiveness as teachers. **The Foundation also announced award of 82 Senior Postdoctoral Fellowships in** the sciences for the fiscal year 1959, selected from 242 applicants.

• **The Mountain Lake Biological Station** has recently been advised by the National Science Foundation that its grant of $18,000 for three years has been renewed (1959–1961). This grant has made available funds for the establishment of awards for research and study at the Station. Three types of awards are available: Postdoctorates, for Research; Predoctorates, for supervised research; and postgraduates, for training in field or laboratory research techniques, thus permitting course work. Application blanks for these awards may be secured from the Director, Mountain Lake Biological Station; Department of Biology, University of Virginia, and must be submitted by *April 1, 1959.*

• **The establishment of the Mississippi Institute of Microbiology,** as a unit of the Department of Biology of Mississippi Southern College, has been announced. B. Q. Ward, bacteriologist and associate professor of biology, has been designated as Director of the Institute. The Institute will be the only organization of its kind in the State of Mississippi. It is essentially a research establishment and is empowered to accept and administer pertinent grants found acceptable to the college. The staff of the Institute also has the additional duty of preparing an annual report of its opinions and suggestions relative to teaching and course work within the academic department. Appointment to the faculty in biology at Mississippi Southern College does not confer Institute membership, nor need a research worker of the Institute teach, but it is expected that Institute personnel will normally be composed of those with dual appointments to both organizations, from the teaching faculty. Appointments for the coming year provide the Institute with a personnel noteworthy not only for its high degree of attainment and

competence, but for scope as well: J. F. Walker, Ph.D., chairman and professor, Department of Biology (physiology and histology); B. Q. Ward, Ph.D., Director of the Institute and associate professor of biology (bacteriology and microbiology); R. A. Woodmansee, Ph.D., associate professor of biology (ecology and marine plankton); A. E. Harrises, Ph.D., associate professor of biology (parasitology); C. R. Ball, M.S., associate professor of biology (embryology); S. W. Rosso, M.A., assistant professor in biology (malacology). Anyone who may desire further information regarding the Institute of Microbiology should address his inquiry to Dr. B. Q. Ward, Director of the Institute of Microbiology, Box 264, Station A, Hattiesburg, Mississippi.

• **Teaching Assistantships for graduate study in the Department of Botany at Yale University are available.** Assistantships provide annual stipends of $2,500 supplemented by $300 summer research awards, making total stipends of $2,800 ($1,000 of this is deducted for tuition). Teaching load permits full course of study. Applications should be made in writing to Chairman, Botany Department, Yale University, New Haven, Conn.

Research assistantships provide annual stipends of $2,800 ($1,000 of this is deducted for tuition). These assistantships are also available at the Connecticut Agricultural Experiment Station, New Haven, in plant pathology, physiology, genetics, and related fields. Applications are due *February 1, 1959.*

• **"Reproductive Physiology and Protein Nutrition" will be the subject of the 15th Annual Conference on Protein Metabolism** to be held at Rutgers University, January 23–24, 1959. The speakers will be Marjorie Nelson, University of California; Fred Andrews, Purdue University; L. E. Casida, University of Wisconsin; F. Gomez Mont, Mexico City; Ralph Reece, Rutgers University; and James H. Leathem, Rutgers University. Discussions will consider the influences of nutrition on male and female reproduction in the rat, on location in rats and farm animals on reproduction in farm animals, on hormonal levels in human malnutrition and the influence of hormones on hormonal relations to nutrition in domestic animals. For further information or registration forms, write to James H. Leathem, Rutgers University, New Brunswick, N. J.

• **An invitation is extended to biologists to participate in an Inter-disciplinary Conference on Self-Organizing Systems** to be held next May 5 and 6, 1959, at the Museum of Science and Industry, Chicago, Ill. This conference is jointly sponsored by the Information Systems Branch of the Office of Naval Research and the Armour Research Foundation, and will attempt in part to bring together interested persons to discuss and develop concepts relating to computer design which may be based upon biological information. For this purpose those biological systems which show "self-organization" or which have a capability for organization whether or not by neuronal mechanisms will receive attention particularly as they may be useful in design for machine learning, machine growth, or what has recently been referred to as "artificial intelligence." Interested individuals may receive further information and a preliminary conference program when available by writing to: Mr. Scott Cameron, ICSOS Conference Secretary, Armour Research Foundation, 10 West 35th Street, Chicago 16, Ill.

• **The National Academy of Sciences-National Research Council has announced a program of Postdoctoral Resident Research Associateships to be offered for 1959–1960.** The participating laboratories are the National Bureau of Standards (Boulder, Colorado and Washington, D. C.); the Naval Ordnance Laboratory (White Oak, Silver Spring, Maryland); the Naval Research Laboratory (Washington, D. C.); the Navy Electronics Laboratory (San Diego, California); and the U.S. Army Chemical Corps Biological Warfare Laboratories (Fort Detrick, Frederick, Maryland).

The Air Research and Development Command is also participating in this program at four Air Force installations. These associateships are tenable at Air Force Cambridge Research Center (Bedford, Mass.); Air Force Missile Development Center (Alamogordo, New Mexico); Rome Air Development Center (Rome, New York); and Wright Air Development Center (Dayton, Ohio). In addition, the ARDC is sponsoring a program of Postdoctoral University Research Associateships tenable at 21 universities in the United States.

The resident research associateships have been established to provide young scientists of unusual ability and promise an opportunity for advanced training in basic research in a variety of fields. Modern facilities are available in specified areas of the biological, physical, and mathematical sciences, and engineering. In addition to the above research in certain areas of psychology is available.

Applicants must be citizens of the United States. They also must produce evidence of training in one of the listed fields equivalent to that represented by the Ph.D. or Sc.D. degree and must have demonstrated superior ability for creative research. Remuneration for these associateships is from $5985 to $7510 a year, subject to income tax.

Application materials may be secured by writing to the Fellowship Office, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N.W., Washington 25, D. C. In order to be considered for awards for 1959–1960, applications must be filed at the Fellowship Office on or before *January 19, 1959.* Awards will be announced about April 1, 1959, by the participating laboratories and research centers.

• **The National Science Foundation has announced 377 grants totaling $12,796,007**, awarded during the quarter ending September 30, 1958, for the support of basic research in the sciences, for conferences in support of science for exchange of scientific information, and for training of science teachers. This is the first group of awards to be made during fiscal year 1959.

• **The Atomic Energy Commission has announced the approval of 30 grants totaling $326,510** to 30 American colleges and universities for assistance in equipping their laboratories for training in nuclear technology as related to the life sciences. The life science grants are for the purpose of helping colleges and universities expand their facilities for training in radiation biology and in the use of radioisotopes in the fields of agriculture, veterinary medicine, medicine and pharmacy, public health and biology.

• **The 1959 session of the Southern Regional Graduate Summer Session in Statistics** will be held at North Carolina State College, Raleigh, from June 8 to July 17, 1959.

North Carolina State College, Virginia Polytechnic Institute, University of Florida, and Oklahoma State University have agreed to operate a continuing program of graduate summer sessions in statistics to be held at each institution in rotation; the program was instituted at Virginia Polytechnic Institute in the summer of 1954.

The 1959 session, like previous sessions under this program, is intended to serve: 1) teachers of introductory statistical courses who want formal training in modern statistics; 2) research and professional workers who want intensive instruction in basic statistical concepts and modern statistical methodology; 3) professional statisticians who wish to keep informed about advanced specialized theory and methods; 4) prospective candidates for graduate degrees in statistics; and 5) graduate students in other fields who desire supporting work in statistics. The session will last six weeks and courses will carry three semester hours of credit. Not more than two courses may be taken for credit at any one session.

The National Science Foundation is offering grants to college teachers of introductory statistics who wish to attend the 1959 session. Stipends of $75 per week for the six weeks of the session plus $15 per week per dependent (up to four) will be made available for a maximum of 30 applicants; in addition, there will be a travel allowance of 4 cents per mile, round trip. Tuition and fees will be paid by the N.S.F.

The courses to be offered in statistics in 1959 at Raleigh are as follows: Statistical Methods I and II, Statistical Theory I, II and III, theory of sampling applied to sur

vey design, stochastic processes and their applications, methods of operations research, advanced topics in statistical methods. A number of courses will, in addition, be available in the Mathematics Department, including differential equations, introduction to determinants and matrices, introduction to applied mathematics, numerical analysis, Advanced Calculus I, boundary value problems.

Applicants for National Science Foundation grants will be selected on the basis of interest in continued teaching of statistics, evidence of excellence as a teacher, previous academic record of the applicant, number of introductory statistics courses now teaching, and number of students contracted. Applications must be received not later than *February 16, 1959*, to be assured of full consideration. Applicants will be notified of the selection committee's action not later than March 16, 1959, and must accept (or decline) a fellowship award not later than April 1, 1959. Requests for application blanks for the summer school and for National Science Foundation grants should be addressed to: F. E. McVay, Department of Experimental Statistics, North Carolina State College, Raleigh, North Carolina.

• **Three out of every four American scientists reported knowledge of at least one foreign language** according to a study released by the National Science Foundation entitled "Foreign Language Knowledge of American Scientists, 1954-55."

About two percent have some knowledge of Russian, one percent of Chinese or Japanese. Such knowledge for the most part stems largely from nativity and family background. These findings indicate that nearly all American scientists must depend on translations for knowledge of scientific developments reported in Russian, Chinese, and Japanese. German was the language reported most often and French next, obviously a reflection of educational requirements for scientific training, particularly at the graduate level. Chemists, chemical engineers, physicists, and astronomers showed a greater concentration in the Germanic languages; psychologists and earth scientists, in French and other Romance languages. This study is based on information supplied by the 127,000 scientists listed in the National Register of Scientific and Technical Personnel in 1954–55. The Register is maintained jointly by the Foundation and a number of cooperating professional scientific societies. It is estimated that during that period, the Register included more than half of all American scientists.

The U.S. Government is currently sponsoring translations of more than 50 Russian scientific journals—32 by the National Science Foundation. The Foundation is now surveying requirements for translations from Chinese and Japanese scientific journals.

Copies of "Foreign Language Knowledge of American Scientists, 1954–55" are available in limited number from the Public Information Office, National Science Foundation, Washington 25, D.C.

• **The second semester of the 1958–1959 academic year has been set aside by the University of Illinois as the "Darwinian Centennial Semester"** to commemorate the 100th anniversary of the publication of *The Origin of Species*. W. M. Luce of the Zoology Department is chairman of an all-university committee which is arranging a series of events for the semester.

• **The Social Legislation Information Service** (1346 Connecticut Ave., Washington 6, D. C.) has issued a guide to "Federal Agencies Financing Research." It lists all agencies offering research grants, fields involved, how to apply, deadlines for receipt of applications, restrictions, etc. The guide may be obtained from the Service for $1.00.

• **Future International Congresses of interest to biologists:**

May 21-27, 1959. Madrid. Spain, 16th International Veterinary Congress. Dr. Jac Jensen, General Secretary of Permanent Committee, Belstraat 168, Utrecht, Netherlands; or Dr. W. A. Hagan, Dean, Cornell University, New York State Veterinary College, Ithaca, New York.

June 15-20, 1959. Paris, France. International Conference on Information Processing, the Natural Sciences Department of UNESCO. Methods of digital computing. Logical design and common symbolic language for machines. Automatic translation of languages, Collection, storage and retrieval of information. Pattern recognition and machine learning. Natural Sciences Department, UNESCO, 19 avenue Kleber, Paris 16e, France.

July 6-11, 1959. Oslo, Norway. International Seed Testing Convention, International Seed Testing Association. The Danish State Seed Testing Station, Thorvaldsenvei, 57, Copenhagen V, Denmark.

August 9–15, 1959. Buenos Aires, Argentina, 21st International Congress of Physiological Sciences. Professor A. O. M. Stoppani, Faculdad de Ciencias Medicas, Paraguay 2155, Buenos Aires.

August 19-28, 1959. Montreal, Canada. 9th International Botanical Congress, International Union of Biological Sciences (IUBS), Dr. C. Frankton, Secretary General, 9th International Botanical Congress, Science Service Building, Carling Avenue, Ottawa, Ontario, Canada.

August 20–Sept. 2, 1959. Vienna and Salzburg, Austria. 14th International Limnological Congress, International Association of Theoretical and Applied Limnology of the International Union of Biological Sciences (IUBS). The Secretary, 14th International Limnological Congress, Biologische Station, Lunz am See, Austria.

August 30–Sept. 6, 1959. Barcelona and Madrid, Spain. 9th International Congress on the History of Science. Professor Jean Vernet, Via Layetona 141, Barcelona, Spain.

August 30–Sept. 12, 1959. New York, N. Y. International Oceanographic Congress, organized by the American Association for the Advancement of Science in cooperation with UNESCO and the Special Committee on Oceanic Research of the International Council of Scientific Unions (ICSU). Dr. Mary Sears, Chairman, Woods Hole Oceanographic Institution, Woods Hole, Mass.

April 11-16, 1960. New York, N. Y. 7th International Congress of Anatomy, Professor Louis Flexner, School of Medicine, University of Pennsylvania, Philadelphia, Pa.

July 11-22, 1960. Reading, England. 8th International Grassland Congress. British Grassland Society, Coley Park, Reading, Berks, England.

July 17-25, 1960. Vienna, Austria. 11th International Congress on Entomology. Professor Dr. D. J. Kuenen, Zoologisch Laboratorium, Kaiserstraat 63, Leiden, Netherlands.

August 15-20, 1960. Madison, Wisconsin. 7th International Congress of Soil Science, International Society of Soil Science. Professor Richard Bradfield, Department of Agronomy, Cornell University, Ithaca, New York.

Sept. 3-8, 1960. Paris, France. 10th International Congress for Cell Biology, International Society for Cell Biology. Professor Chevremont, 20, rue de Pitteurs, Liege, Belgium.

Undecided, 1961. London, England (Tentative). 2nd International Congress on Human Genetics. Secretariat, 1st World Congress on Human Genetics, 14 Tagensvej, Copenhagen N, Denmark.

• **Attention has been drawn to a typographical error** that appeared in the November issue of the AIBS BULLETIN. On p. 34, Dr. Wallace (Cold Spring Harbor) should have read *Bruce* Wallace not *Ruth* Wallace. Our apologies for the error. *Ed.*

• **Fred R. Cagle,** chairman of the department of zoology at Tulane University, has been appointed coordinator of the Tulane research program. Principal duty of the coordinator will be to maintain liaison with other universities, government research centers and industrial laboratories. Dr. Cagle will also make recommendations on policy, assist in negotiations for support of research and maintain a central information source. Since 1954, Dr. Cagle has served as editor-in-chief of "Copeia," principal American journal devoted to scientific study of fishes, reptiles and amphibia.

• **Helen L. Jeffrey,** formerly of the National Science Foundation, has been named

Executive Secretary of one of two Biochemistry Study Sections, Division of Research Grants, National Institutes of Health, Bethesda, Md.

• **Donald B. Anderson** has been named provost and vice president of the University of North Carolina and assumed his duties in Chapel Hill November 1. For many years, Dr. Anderson has been professor of botany, chairman of the division of biological sciences, and dean of the graduate school at the North Carolina State College division of the University, and during the past several years has been on leave of absence to serve as program director in the scientific personnel and education division of the National Science Foundation.

• **Robert S. Leisner,** who recently received his Ph.D. in botany from the University of North Carolina has accepted a position as assistant to the executive director of the AIBS.

• **John H. Davis,** University of Florida, is now at the University of Mandalay, Mandalay, Burma. He will be there for 3 years on a grant from the University of Florida and the Ford Foundation.

• **Alan Conger,** formerly of the Oak Ridge National Laboratory, has joined the staff of the Botany and Biology Department at the University of Florida as professor of radiation biology. He will develop a teaching and research program in that area.

• **Warren M. Deacon** recently retired from the chairmanship of the Department of Biology at Vanderbilt University, Nashville.

• **Robert E. Gordon** is now in the Department of Biology, University of Notre Dame, Notre Dame, Indiana.

• **Neal Weber,** Swarthmore College, recently received an honorary degree from the University of North Dakota during a special 75th Anniversary Convocation.

• **Professor Hannes Laven** of the Max Planck Institut für Biologie, Tübingen, Germany, is spending the current academic year in the Zoology Department of the University of Illinois as a George A. Miller Visiting Professor in Zoology.

• **M. J. Greenberg** has been added to the staff of the Zoology Department of the University of Illinois in the field of invertebrate zoology.

• **Y. Sinoto** of the International Christian University, Japan, and Editor of *Cytologia* visited the Zoology Department of the University of Illinois during October.

• **Frank M. Carpenter,** chairman of the Biology Department of Harvard University, has been elected the new 1959 president of Sigma Xi, national scientific honorary fraternity.

• **R. Omar Rilett,** formerly associate professor of biology at the University of Buffalo, has taken up his new duties as professor and head of the department of biological science at Illinois State Normal University, Normal, Ill. He succeeds **Ernest M. R. Larıkey,** who has retired. Dr Rilett recently returned from a sabbatical, which he spent as visiting investigator at the Pest Infestation Laboratory, Slough Bucks, England.

• **Theodosius Dobzhansky,** professor of zoology at Columbia University, will lecture on biology and genetics at the University of Sydney, Sydney, Australia, during 1959–60. Dr. Dobzhansky is a geneticist and a specialist in the evolutionary differentiation of species.

• **Kenneth W. Prescott,** director of the Kansas City Museum (Mo.), has been named by the Academy of Natural Sciences, Philadelphia, Pa., to the new post of managing director of the Philadelphia National History Museum. Dr. Prescott is a zoologist whose specialty is ornithology.

• **Two noted researchers have joined the zoology department at Southern Illinois University: Richard Kudo,** protozoologist, and **Richard Blackwelder,** a specialist in the classification of insects. Dr. Kudo is working on the giant amoeba, while Dr. Blackwelder is working on animal classification.

• **Harold H. Smith,** senior geneticist at Brookhaven National Laboratory, has been appointed for a period of one year to the staff of the International Atomic Energy Agency, Vienna, Austria, in connection with programs in genetics, biology, and agriculture.

• **Verl House,** formerly head of the biology department of Radford College, has been named associate professor of genetics in the department of zoology and entomology at Ohio State University.

• **George W. Hunter, III,** was honored recently by the Cuban Government at the annual meeting of the National Academy of Sciences of Havana. Col. Hunter was awarded a decoration in the rank of "Official" in the Order of Carlos J. Finlay in recognition of his work in tropical medicine.

Recent deaths among biologists:

Edwin Betts, Charlottesville, Va.; professor of biology at the University of Virginia and an authority on the gardening and farming practices of Thomas Jefferson. 65; September, 1958.

Andrew A. Borland, University Park, Pa.; head of the department of dairy science at the Pennsylvania State University from 1919 until his retirement in 1948; head of animal and dairy husbandry at the University of Vermont from 1911 to 1915. 80; October, 1958.

Warren S. Bourn, Munden, Va.; retired biologist of the U.S. Fish and Wildlife Service, Division of Wildlife Refuges; internationally known as a specialist on marsh ecology. 62; August, 1958.

William A. Dayton, Arlington, Va.; plant scientist with the Department of Agriculture's Forest Service for 45 years; chief of the Division of Dendrology and Range Forage Investigations since 1942. 73; October, 1958.

P. F. English, State College, Pa.; professor of wildlife management at Pennsylvania State University since 1938; head of the department of zoology and entomology from 1951 to 1953; president of the Wildlife Society since 1946. 64; October, 1958.

Robert T. Moore, Los Angeles, Calif.; ornithologist and retired research associate professor in vertebrate zoology, California Institute of Technology and Occidental College; director of the Moore Zoological Laboratory at Occidental. 76; October, 1958.

John T. Nichols, New York, N.Y.; curator of the department of recent fish at the American Museum of Natural History from 1927 until his retirement in 1952; founder and president of the American Society of Ichthyologists and Herpetologists; founder of *Copeia*. 75; November, 1958.

Benjamin P. Young, Ithaca, N.Y.; professor emeritus of zoology at Cornell University. 71; October, 1958.

From the Societies

• **The 6th annual meeting of the Entomological Society of America** was held at Salt Lake City, Utah, December 1–4, 1958. Approximately 650 members and guests were in attendance. The address of welcome was given by The Honorable George D. Clyde, Governor of Utah. Of special interest was the address of the President, R. L. Metcalf, on "Organophosphorus Insecticides: Their Applications to Applied and Fundamental Research." Fred L. Soper spoke on "World Wide Malaria Eradication: Progress Report," while the L. O. Howard Memorial Lecture "Metamorphosis: A Tool for the Study of Growth" was given by Carroll M. Williams, Harvard University. A symposium on Resistance to Insecticides, of which A. W. A. Brown of the World Health Organization was the moderator, was well received.

P. W. Oman, U.S. Department of Agriculture, was installed as President for 1959. M. P. Jones, also of U.S. Department of Agriculture, is President-Elect. F. W. Poos was appointed Managing Editor of Society publications. Manuscripts intended for publication in Society journals are to be sent to the office of the Executive Secre-

tary for initial review prior to assignment to subject editors. A new publication, "Miscellaneous Publication of the Entomological Society of America" will be launched in 1959. The 1959 meeting is to be held in conjunction with the Entomological Society of Canada in Detroit, Michigan, November 30–December 3.

• **New officers of the Botanical Society of America are:** Honorary President Harry J. Fuller, University of Illinois, Urbana; President, William C. Steere, New York Botanical Garden, New York 58; Vice-president, Vernon I. Cheadle, University of California, Davis; and Secretary, B. L. Turner, University of Texas, Austin. Continuing in office is the Treasurer, Aaron J. Sharp, University of Tennessee, Knoxville.

At the Annual Dinner held in Bloomington, Indiana, the following **"Certificates of Merit"** for 1957 were awarded: **Harry J. Fuller,** University of Illinois, "For continued self-sacrificing service to Botany, whether as a teacher, a writer of needed textbooks, an editor, or as an officer of the Botanical Society of America."; **Philip A. Munz,** Director, Rancho Santa Ana Botanic Garden, Claremont, Calif., "For his penetrating studies of the Onagraceae, of the flora of California, and for his farsightedness and breadth of purpose resulting in the development of a model botanical garden."; **Lester W. Sharp,** Cornell University, Ithaca, for "His contributions, both by personal investigation and by successive editions of carefully edited textbooks, have made plant cytology a significant field of Botany."

The Darbaker Award for 1957–1958 ($250 each) was presented to **Paul Silva** and **Ralph Lewin. The Cooley Award** of the American Association for Plant Taxonomists was received by **Richard Howard.**

• **The Genetics Society of America elected the following 1958–1959 officers:** President, Karl Sax, Harvard University; Vice-President, J. W. Boyes, McGill University; Secretary, W. L. Russell, Oak Ridge National Laboratory; Treasurer, R. D. Owen, California Institute of Technology.

• **The International Association for Dental Research will hold its 37th General Meeting March 19–22, 1959, at the Sheraton-Palace, San Francisco, Calif.** The E. H. Hatton Award Competition, consisting of $100 award for the best (as judged by a committee) presentation of original research by a novice or novices will be presented at this annual meeting. Current officers of the Association are: President, Ned B. Williams; President-Elect, H. B. G. Robinson; Vice-President, Holmes T. Knighton; Editor of the *Journal of Dental Research*, Frank J. Orland.

• **New officers for the Society for the Study of Evolution are:** President, Edgar Anderson; Vice-Presidents, Harlan Lewis, J. W. Gregor and N. Tinbergen; Secretary, Herbert H. Ross, State Natural History Survey, Urbana, Ill.; Editor of *Evolution*, I. Michael Lerner.

• **The Annual Meeting of the Biophysical Society will take place February 25–27, 1959, in Pittsburgh.** This year's invited papers will center on "Antibodies" and on "Sensory Systems." Contributed papers on all fields of biophysics will be presented by nonmembers as well as members. For further information, write: Dr. Gary Felsenfeld, Department of Biophysics, University of Pittsburgh, 325 Clapp Hall, Pittsburgh 13, Pa.

• **Elsie Quarterman,** Vanderbilt University, has been appointed vice-president of the American Bryological Society for the balance of the terms of Ronald L. McGregor's office. Dr. McGregor, University of Kansas, will be in Mexico during the coming year.

• **The 1959 symposium of the Society for the Study of Development and Growth will be held at the University of Wisconsin, June 11–13, 1959.**

The new Executive Committee of the Society consists of Ralph Erickson, President; Edgar Zwilling, Treasurer; William P. Jacobs, Biology Department, Princeton University, Secretary; Dorothea Rudnick, Editor. The limitation on the number of members in the Society has been raised from 300 to 500.

• **The Conference of Biological Editors will hold its second Annual Meeting at the Chicago Natural History Museum, Chicago, Ill., April 11–12, 1959.** Theodor Just, Chicago Natural History Museum, is Chairman of the Local Committee.

• **The 1959 Meeting of the American Society of Mammalogy will be held June 21–24 in Washington, D. C.** Two $100 honoraria, granted annually on a competitive basis to young predoctoral mammalogists for research papers read at the annual meetings, will be awarded.

• **The American Society of Parasitologists will hold its 1959 annual meeting August 30–September 3 at Pennsylvania State University,** University Park, Pa., in conjunction with other AIBS-sponsored meetings.

1958–59 officers of the Society are: President, Aurel O. Foster, U.S.D.A., Beltsville, Md.; President-Elect, Harold W. Brown, Columbia University School of Public Health; Vice-President, Robert M. Stabler, Colorado College, Colorado Springs, Colo.; Secretary, Paul E. Thompson, Parke, Davis & Company, Detroit 32, Mich.; Treasurer, Martin J. Ulmer, Iowa State College, Ames, Iowa; Custodian, Wilford S. Bailey, Alabama Polytechnic Institute, Auburn, Ala.; Editor of the *Journal of Parasitology*, Elery R. Becker, Arizona State College, Tempe, Ariz.

During its 1958 annual business meeting, the Society elected **David H. Wenrich,** Department of Zoology, University of Pennsylvania, an Emeritus Member, and Professor **Rupert Montgomery Gordon,** Liverpool School of Tropical Medicine, an Honorary Member.

The Society is pleased to announce that it will confer annually, or less often, **an award for meritorious research in parasitology.** The award, sponsored by Parke, Davis & Company, will consist of a check for $1,000, a medal, and $150 travel allowance for the recipient. It has been named in honor of Henry Baldwin Ward, who founded the Society's *Journal of Parasitology* and served as the Society's first president. Members of the Society whose accomplishment occurs within 15 years after the completion of academic training are eligible for the award. Selection will be made by the Society's Awards Committee.

• **The Ecological Society of America elected the following new officers for 1959:** President, Thomas Park; President-Elect, Charles E. Olmsted; Vice-President, Aaron J. Sharp.

The George Mercer Award for the best paper in ecology was won by **Jerry S. Olson,** Oak Ridge National Laboratory, for the paper, "Rates of Succession and Soil Changes in Southern Lake Michigan Sand Dunes." (Bot. Gaz. 119:125–170. 1958.) **The Eminent Ecologist Award** of the E.S.A. was presented to **A. W. Sampson,** Professor Emeritus of Forestry, University of California, Berkeley.

• **New officers of the American Society of Plant Physiologists are:** President, Sterling B. Hendricks, U.S. Plant Industry Station, Beltsville, Md.; Vice-President, A. Carl Leopold, Purdue University, Lafayette, Ind.; Member of Executive Committee, Harry A. Borthwick, U.S. Plant Industry Station, Beltsville, Md.; Members of the Editorial Board, A. S. Crafts, University of California, Davis, and Paul J. Kramer, Duke University, Durham, N. C.

At the recent annual meeting of A.S.P.P., the **Stephen Hales Prize** was awarded to **F. W. Went,** California Institute of Technology; and the **Charles Reid Barnes Life Membership** was awarded to **P. Boysen Jensen,** Plant Physiology Laboratory, University of Copenhagen.

• **The American Ornithologists' Union held its 75th Anniversary Meeting October 14–19, 1958, at the American Museum of Natural History, New York City.** The following are officers for the coming year: President, Ernst Mayr, Harvard University; First Vice-President, George H. Lowery, Jr., Louisiana State University, Baton Rouge; Second Vice-President, Dean Amadon, American Museum of Natural History; Editor, Eugene Eisenmann, American Museum of Natural History; Secretary, Herbert G. Deignan, U.S. National Museum, Washington,

D.C.; Treasurer, Charles G. Sibley, Cornell University.

The Brewster Memorial Award, by action of the Council, was presented to **Arlie W. Schorger,** University of Wisconsin, for his study, "The Passenger Pigeon: Its Natural History and Extinction" (Madison, 1955).

• **1959 officers of the Mycological Society of America** were elected during the Society's annual meeting with AIBS, August 1958. They are: President, C. J. Alexopoulos, State University of Iowa; President-Elect, C. W. Emmons, National Institutes of Health; Vice-President, L. S. Olive, Columbia University; Secretary-Treasurer, E. S. Beneke, Michigan State University (1957–1959); Councilor (East), John R. Raper, Harvard University; Councilor (West), W. G. Solheim, University of Wyoming.

• **F. P. Cullinan** has been appointed to represent the American Society for Horticultural Science on the Executive Board of the American Horticultural Council, filling the vacancy caused by the resignation of **P. R. Krone.**

• **The American Association of Anatomists will hold its next annual meeting April 1–3, 1959, at the University of Washington, School of Medicine, Seattle.** New officers of the Association are: President, Normand L. Hoerr, Western Reserve University, Cleveland; President-Elect. Edward W. Dempsey, Washington University School of Medicine, St. Louis, Mo.; President-Emeritus, Davenport Hooker, Yale University.

• **The American Physiological Society's spring meeting will be held in Atlantic City, April 13–17, 1959.** The Symposia at this meeting will be "Space Biology," "Biological Rhythms," and "Central Regulation of Circulation."

Summer Research Traineeships are available to college teachers of physiology, and the Porter Fellowship is available for the last year of predoctoral training in physiology. For further information and application forms write: American Physiological Society, 9650 Wisconsin Avenue, Washington 14, D. C.

• **At its 49th Annual Convention in July, 1958, the National Shellfisheries Association re-elected the following officers for 1958-1959:** President, Melbourne R. Carriker, University of North Carolina; Vice-President, L. Eugene Cronin, Maryland Department of Research and Education, Solomons, Md.; Secretary-Treasurer, Philip A. Butler, Shellfishery Laboratory, U.S. Fish and Wildlife Service, Gulf Breeze, Fla.

• **New officers for 1959 were installed during the meeting of the National Association of Biology Teachers** with the AAAS in Washington, December, 1958. They are as follows: President, Paul Klinge, Indiana University; President-Elect, Howard Weaver, University of Illinois; First Vice-President, H. Seymour Fowler, Pennsylvania State University; Second Vice-President, Lorenzo K. Lisonbee, Camelback High School, Phoenix, Ariz.; Third Vice-President, Robert L. Smith, DeKalb High School, DeKalb, Ill.; Secretary-Treasurer, Paul V. Webster, Bryan High School, Bryan, Ohio.

• **The American Phytopathological Society has elected the following officers for 1959:** President, Glenn S. Pound; President-Elect, William C. Snyder; Vice-President, S. E. A. McCallan; Secretary, William B. Hewitt; Treasurer, A. W. Domock; Editor-in-Chief, E. E. Wilson; Retiring President, Paul R. Miller. The Society will hold its 1959 meetings at Pennsylvania State University with AIBS.

• **1959 officers of the Society of Industrial Microbiology** were announced at the Society's meeting with AIBS at Bloomington. They are: President, C. L. Porter, Purdue University, Lafayette, Ind.; Vice-President, Leland McClung, Indiana University; Secretary, Brinton Miller, Merck Sharp & Dohme, Rahway, N. J.; Treasurer, Arthur Kaplan, Army Quartermaster Corps, Natick, Mass.; Director 1958–60, E. L. Dulaney, Merck Sharp and Dohme, Rahway, N. J.

It has been suggested that a digest of S.I.M. meetings and symposia be published. All members who believe such a report on these activities would be worthwhile are urged to send their suggestions to the Secretary, Brinton M. Miller, Merck Sharp & Dohme Research Laboratories, Rahway, New Jersey.

• **The Potato Association of America will meet at Fredericton, New Brunswick, Canada, August 12–16, 1959.** Newly elected officers are: President, W. G. Hooker; President-Elect, P. G. Eastman; Director, C. E. Cunningham; Vice-President, O. T. Turnquist. Other officers remain the same.

• **All future subscriptions to the *Journal of Parasitology*** should be sent to: American Society of Parasitologists, Martin J. Ulmer, Treasurer, Department of Zoology and Entomology, Iowa State College, Ames, Iowa.

• **The American Society of Plant Taxonomists** elected the following officers for 1959: President, William C. Steere, New York Botanical Garden; Chairman of the Council, A. C. Smith, U. S. National Museum; Secretary: C. Ritchie Bell, University of North Carolina; Treasurer, Charles B. Heiser, Jr., Indiana University; Editor-in-chief, *Brittonia*, Rogers McVaugh, University of Michigan; Managing Editor, *Brittonia*, H. W. Rickett. Warren H. Wagner, University of Michigan was elected to the Council for a seven-year term.

The Constitution of the A.S.P.T. has been revised to add a membership category for retired members. Also a new by-law was adopted to establish a class of student membership, with reduced dues ($4.50).

The Cooley Award for the best paper on the southeastern flora published during the calendar year 1957 was made to **James W. Hardin** for a Revision of the American Hippocastanaceae, Brittonia 9: 145-171, 173–195. 1957. The Cooley Award for the outstanding paper presented before a session of the Society at Bloomington went to **Richard A. Howard** for Vascular Anatomy of the Petiole as a Taxonomic Character. These awards are made possible through the generosity of one of the Society members, George R. Cooley.

• **The American Society of Zoologists** elected the following officers for 1959: Past-President, H. Burr Steinbach, University of Chicago; President, Victor C. Twitty, Stanford University; President-elect, Emil Witschi, State University of Iowa. The other officers remain unchanged.

Members of the Executive Committee to serve through 1961 are: Lewis Kleinholz, Reed College, and Edgar Zwilling, University of Connecticut.

• **The 1959 annual meeting of the Association of Southeastern Biologists will be held April 16–18 at the University of Tennessee, Knoxville.** On the afternoon of April 16, the Biology Division of the Oak Ridge National Laboratory will conduct tours of its buildings for the benefit of those en route to the meetings.

Volume V, Numbers 3 and 4 (combined) of the Bulletin of the Association of Southeastern Biologists, which was published in November, contains both an alphabetical directory of the nearly 700 members of the society and a geographic directory in addition.

New officers elected in April, 1958, at the Tallahassee, Florida, annual meeting are: President-Elect, Horton H. Hobbs, University of Virginia; Vice-President, Victor A. Greulach, University of North Carolina; Secretary, Harold J. Humm, Duke University; Members of the Executive Committee, William Burbanck, Emory University, and Elsie Quarterman, Vanderbilt University. Geoffrey M. Jeffrey, U.S. Public Health Service, Columbia, S.C., was appointed Editor of the Bulletin by the Executive Committee to replace Victor A. Greulach who resigned. Dr. Jeffrey will begin his duties as Editor with Number of Volume VI to appear in January, 1959.

A Research Fellowship of $150 for summer research at the Mountain Lake Biological Station of the University of Virginia will be offered again for the summer of 1959 by the Phipps and Bird Company of Richmond to members of the Association of Southeastern Biologists. The recipient of the award will be announced at the Knoxville meeting. The Meritorious Award for Teaching will be made again in 1959 to a member of the Association of Southeastern Biologists and will include

an honorarium of $100 provided by the Will Corporation of Georgia.

A prize of $100 will be awarded a member of the Association of Southeastern Biologists again in 1959 at the annual meeting at the University of Tennessee for an especially meritorious paper presented at the meetings. The Carolina Biological Supply Company of Elon College, N. C. sponsors this prize.

As a result of the interest and generosity of Mr. C. M. Goethe of Sacramento, Calif., funds to assist several graduate students in attending the Knoxville meeting of the Association of Southeastern Biologists will be available again in 1959. The fund has been established by Mr. Goethe in honor of Mary Glide Goethe.

Education and Manpower

• **B. R. Stanerson, of the American Chemical Society, Washington, has been elected President of the Scientific Manpower Commission for 1959.** Dr. Stanerson has been a member of the commission since it was founded in 1953 by the ten largest scientific organizations of the United States. **Frank P. Cullinan,** Agricultural Research Service, Beltsville, Md., was re-elected Vice President, and **John E. Foster,** Animal Husbandry Department, University of Maryland, was re-elected Secretary-Treasurer.

• **Summer Institutes in Radiation Biology for high school and college science teachers have been announced by the U.S. Atomic Energy Commission and the National Science Foundation.** The following schools are listed (*for college teachers only): 1) Adelphi College, Garden City, Long Island, New York; Director: H. A. Robinson (1958–1959); 2) Baylor University, Waco, Texas; Director: Bryce C. Brown (1958–1959); 3) Brigham Young University, Provo, Utah; Director: L. A. Compton (1958–1959); 4) University of California School of Medicine, Los Angeles 24, Calif.; Director: R. L. Libby (1957–1958–1959); 5) Duke University, Durham, North Carolina; Director: Donald J. Fluke (1956–1957–1958–1959); 6) Howard University, Washington 1, D. C.; Director: Marie C. Taylor (1958–1959); 7) University of Kansas, Lawrence, Kansas; Director: E. I. Shaw (1959); 8) University of Michigan*, Ann Arbor, Michigan; Director: Melvin Levine (1959); 9) Montana State University, Missoula, Montana; Director: L. H. Harvey (1958–1959); 10) University of New Mexico, Albuquerque, N. Mex.; Director: H. O. Reid (1956–1957–1958–1959); 11) Ohio State University, Columbus, Ohio; Director: J. S. Richardson (1959); 12) University of Puerto Rico, College of Agriculture and Mechanic Arts, Mayaguez, Puerto Rico; Director: J. A. Ramos (1959); 13) Purdue University, Lafayette, Indiana; Director: R. R. Armacost (1958–1959); 14) Syracuse University, Syracuse, N. Y.; Director: M. W. Jennison (1959); 15) Tuskegee Institute, Tuskegee Institute, Alabama; Director: J. H. M. Henderson (1959); 16) University of Washington, Seattle, Washington; Director: A. D. Welander (1959); 17) University of Washington*, Seattle, Washington; Director: A. D. Welander (1959); 18) Wayne State University, Detroit 7, Michigan; Director: A. J. Vorwald (1957–1958–1959); 19) University of Wyoming, Laramie, Wyoming; Director: Carl A. Cinnamon (1958–1959).

• **A nationwide competition to help improve the use of scientific apparatus for the teaching of physics has been announced by the American Association of Physics Teachers.** The contest, financed by a grant from the W. M. Welch Scientific Company, will take place at the annual meeting of A.A.P.T. at the Hotel New Yorker (New York) on January 28–31, 1959. It is the first competition of this kind and is under the administration of the Committee on Apparatus for Educational Institutions. There will be six awards, ranging in value from $100 to $500. They will be in two categories: equipment used in demonstration lectures in introductory college physics and equipment used in the introductory college physics laboratory.

• **The popular booket, "Careers in Animal Biology," has just been reprinted by the American Society of Zoologists.** This 16-page booklet, which was written for high school seniors and college students, describes career opportunities in basic and applied biological fields in schools, universities, research institutions, hospitals, government agencies, and industrial laboratories. It provides specific information about the duties of each position, kind of preparation required, opportunities for advancement, and salary to be expected. Copies of the booklet may be obtained from the Secretary of the American Society of Zoologists, Dr. Gairdner B. Moment, Goucher College, Baltimore 4, Md. The price is 25 cents for a single copy, or 10 copies for $1.50, 50 for $6.00, 100 for $10.00, 1,000 for $80.

• **The National Science Foundation invites proposals from State Academies of Science requesting support of projects planned to improve the status of science and mathematics education in their respective areas.** Proposals of this type will also be considered from similar nonprofit scientific organizations, particularly in those states having no Academy. It is anticipated that most proposals under this program will fall under one of the headings:

1. Development of collaborative efforts by professional scientists and high school science teachers to improve science instruction;
2. Development of coordinated programs for stimulating interest in science among young people, principally at the pre-college level and providing them with opportunities for science experience;

however, proposals with similar objectives not described in the two categories above will be considered. Novel ideas designed to accomplish the objectives indicated above are encouraged so long as they reflect the general spirit of the program outlined herein.

The numerous state and local organizations known as Academies of Science have basic purposes which parallel those of the National Science Foundation. Although the Academies are independent and autonomous, in general it is true that they have such common objectives as: 1) stimulation of interest in science among young people; 2) improvement of science instruction at all levels; 3) dissemination of scientific knowledge among their widespread membership including not only scientists from the colleges and secondary schools but also those from industrial, governmental and private establishments of the region served; and 4) interpretation of science and the need for better science education to the general public.

The proposals should contain all the detailed information which will help the Foundation determine the nature and relative merit of the proposed project. It is important that the proposal contain a most careful, yet concise, description of *what* kind of a program is planned, *how* it will be accomplished, *who* will direct and staff the project, and *when* the program is to be activated. It should be noted that it is the proposal as such that is evaluated and not in any sense the organization or institution submitting it.

Support by the Foundation may include items such as: expenses of college scientists while visiting high schools—or meetings of high school teachers—for lectures or consultations; expenses of high school science teachers and/or students to attend meetings, conferences, workshops, or field trips planned for them by the sponsoring agency; necessary administrative expenses and supply costs directly related to the proposal. However, under this program support will not be given for scholarships, awards or honoraria. It is not the Foundation's intent to establish new academy offices or initiate employment of permanent personnel for the purpose of carrying out these proposals.

Indirect costs at not more than 15% of the direct costs for staff and operations may be allowed if appropriately incurred, and provided they are not otherwise included. Proposals should be addressed to: Special Projects in Science Education Section, Scientific and Personnel Division, National Science Foundation, Washington 25, D. C. Receipt will be acknowledged. Proposals will be accepted until *February 16, 1959.*

• **The American Society for Horticultural Science has published an attractive booklet "Horticulture—A Challenging Career"** for distribtuion to high school counselors and students. The brochure is available from the Secretary, Dr. Roy E. Marshall, Michigan State University, East Lansing, Michigan, or at most colleges having departments of horticulture.

• **The National Science Foundation has announced the initiation, on an experimental basis, of a program to encourage appropriate groups to set up specially devised study opportunities in the fields of science and mathematics for secondary school students of high ability.** Proposals are invited from colleges, universities and nonprofit research organizations for the summer of 1959. Proposals sponsored by secondary schools are not eligible under this program. However, the facilities of secondary schools can be utilized in college-sponsored, off-campus programs where this is mutually acceptable. A wide variety of programs will be supported, including but not limited to one or more of the following features: classwork, laboratory visits, field trips, special orientation lectures in the field of scientific endeavor, and research participation activities in which students work with experienced scientific investigators.

Under this program Foundation support may include expenses of some or all of the student participants for room, board, travel (including commuting) and other essential items when appropriate. Support may also be given for costs of the sponsoring institution. Direct costs may include fractions of staff salaries properly attributable to the program, payments to high school science teachers as auxiliary participants and counselors, and other necessary administrative expenses and supply costs.

Proposals for 1959 summer programs of this type must be received not later than *January 5, 1959*, by the Special Projects in Science Education Section, Division of Scientific Personnel and Education, National Science Foundation, Washington 25, D. C. Suggestions for the preparation of proposals are available from the same source.

• **Approximately 18,000 high-school and college teachers of science and mathematics will directly benefit during the summer of 1959 from teacher training programs sponsored by the National Science Foundation at 350 Summer Institutes in 255 educational institutions.** Awards of grants totaling approximately $21,000,000 for the support of the Summer Institutes have been announced. Institutes will be held in all 49 states, Hawaii, Puerto Rico, and the District of Columbia. Roughly 300 of the institutes will be open only to high-school teachers. Approximately 30 will be for college teachers only, and about 20 will be for both high-school and college teachers. Roughly 16,000 high-school teachers and 2,000 college teachers will be enabled to participate through stipends provided by the National Science Foundation.

Participants will be chosen by the institutes themselves, *NOT* by the National Science Foundation. Inquiries and applications for participation should be addressed to directors of the individual institutes. Please contact the National Science Foundation for a complete list of Summer Institutes and directors.

• **The Society of American Bacteriologists recently established a Committee on Education** with L. S. McClung, Department of Bacteriology, Indiana University, Bloomington, as Chairman. In addition to developing experiments, lists of films, books, journal references and other teaching aids suitable for use in classes in introductory biology, the Committee will give attention to the training in microbiology of teachers of elementary high school and college biology. Comments, suggestions and inquiries relating to the committee activities should be sent to the chairman or to the following other members of the committee: Milton J. Foter, U. S. Public Health Service, Cincinnati; Noel H. Gross, Fort Detrick; David Hendlin, Merck and Company, Inc.; Raymond W. Sarber, Parke, Davis and Company; I. L. Shechmeister, Southern Illinois University; Grant Stahly, Ohio State University; John Sugg, Cornell University Medical School and Delaphine G. R. Wyckoff, Wellesley College.

Letters to the Editor

November 25, 1958

In a recent issue of *Science* (*127*: 606, 1958) Dr. Sidney Greenfield has commented upon Dr. Fletcher Watson's proposals for a college curriculum for high school science teachers (Sci. Mon. 85: 320, 1957). Dr. Greenfield's major objection seems to be that the courses proposed by Dr. Watson in the field of biology leave out major segments of biology and provide a very poor foundation for the teaching of biology. I agree with Dr. Greenfield that the proposed biology curriculum could be considerably improved. This improvement can be made, I think, almost within the limits proposed by Dr. Watson, provided one thinks a little about the basic courses a biology major really needs. This problem is one that I have been wondering about for reasons other than those raised by Dr. Watson.

In considering the problem, raised by Dr. Watson, or training high school science teachers several factors must be kept in mind, namely: (1) that the high school science teacher must be conversant with more than just one field of science, (2) he must get his training in four years, with possibly a year of postgraduate work, and (3) he should be a liberally educated person and therefore take courses outside science. As a result, the science courses that the prospective high school science teacher can take are limited in number and compromises must therefore be made. There will undoubtedly be fields of science that a teacher trained with a limited number of courses will be ignorant of, but then no one knows 'all he should about his field,' even after getting a Ph.D.

For the present I would accept Dr. Watson's suggestion that every science teacher should have a basic one-year course in each of the following fields: physics, chemistry, biology, and mathematics. In addition to these basic courses I feel that Dr. Watson's suggestion of two sub-majors is a good idea, i.e., a biology-general science specialization and a physics-chemistry-mathematics major. My discussion will be limited to further suggestions for the biology-general science major. For this sub-major I would propose the following courses:

1. General Ecology. A year course dealing with the elements of ecology and covering the elements of plant and animal taxonomy necessary for extensive field work. This course should provide the high school teacher with the background to satisfy the interest of many high school students in natural history and also enable the teacher to take this interest beyond the 'ain't nature grand' stage.

2. Cellular Biology. A year course covering the elements of cellular morphology and the general problems of cellular physiology, such as energy relationships, permeability, photosynthesis, muscle physiology, etc. This course would introduce the student to some of the problems in 'modern' biology.

3. Genetics. A semester course with lab, if possible. This course certainly ought to cover the elements of population genetics and the modern understanding of the mechanisms of evolution. The elements of classical genetics, presumably would be covered in introductory biology.

These three courses, with introductory biology, represent to me the bare minimum as far as biology is concerned. In addition to these courses I would include the following courses:

1. Organic chemistry. A year course with laboratory. This course should be taken before cellular biology.

2. Geology. A year course. This course ideally should be taken before the ecology course, but might be taken concurrently with it. This course provides the knowledge of the physical environment for the ecology course. In addition, it fills out the background needed to discuss 'natural history' with high school students.

3. Meteorology. A semester course. This course, if worked out properly, would entail many of the elements of physics, chemistry, and biology; thus this course could be an overall integrative course. The subject matter is certainly one in which student interest should be high at both the college and high school level.

4. If possible, an additional semester course in biology taken from the study of a specific group of organisms or specified field, for example: microbiology, parasitology, entomology, algology, dendrology, etc.

In a fifth year a person could take some advanced physics or chemistry, and an advanced course in biology. If desired, a course in vertebrate or comparative physiology might be offered at this level. The elements of organ physiology would certainly be covered in the introductory biology course, so that a course in mammalian physiology would not have to be in the undergraduate curriculum. Any additional amount of organ physiology needed for high school teaching could be obtained by reading, particularly with the base of cellular biology to help point up the major problems of physiology or by taking one of the courses above in a fifth year. For a person concerned with general science, astronomy would be a must during this year. The elements of atomic physics, "needed to understand the role of radioisotopes in biology," I would hope could be covered in a modern introductory physics course.

In order to get more 'depth' in biology several other things could be done. One possibility might be a summer research program between the junior and senior years. If each prospective science teacher spent one summer on a small research project, he would certainly gain a better understanding of what science is really like and in addition would learn more about a specific field of biology. Along with the research project the person might take a seminar in a field of special interest or related to the field of the research project. Another possibility might be the alteration of the basic four courses by fusing chemistry and physics. This fusion has been done at Wabash College, with apparently considerable success (J. Chem. Ed. 35: 246, 1958). This fusion would certainly be one way of achieving some breadth and at the same time leaving room for more biology or other advanced science courses in the training of science teachers.

I realize the proposal above is a little more restrictive and heavier than that proposed by Dr. Watson. However, I feel that the biology has been cut to the bare minimum.

William Battin, Simpson College, Indianola, Iowa

December 16, 1958

The letter from Dr. W. Grierson (AIBS BULLETIN, Nov. 1958) concerning the use by professional biologists of their highest academic degree on all occasions, even social, is timely and important.

It has been my feeling for a long time that professional biologists should use the suffix indicating their highest academic degree whenever this is possible. I feel that all letters, all published papers, and like communications should bear this designation. It is my strong contention that the professional biologists with the doctorate should demand that he be referred to as "doctor" on all occasions.

I know that a few individuals who are infected with our modern virus of "pseudo-democracy" will protest that this is not fitting and indicates that the individual concerned lacks suitable modesty. Such a comment is irrelevant and specious. I contend that it is very important to the welfare of our profession that we biologists do all within our power to raise the status of our profession in the eyes of our fellow men. One of the ways of aiding the cause is by the use of the academic degree in connection with our names.

If anyone will examine the files of the various medical journals, for example the *Armed Forces Medical Journal*, it becomes clearly evident that authors are required to include behind their names their highest academic degree. This is good and proper. I feel that all our biological journals should demand such designation from the authors. In this connection, I suggest that we should demand that popular publications, such as the *New York Times*, refer to professional biologists, who possess the doctorate, as "Doctor". There is now a fettish among the editors of many newspapers of referring to medicine men only as doctor. The professional men in other fields, although they may have the doctorate, are still referred to as mister.

In my own small way, I have attempted to start a proper custom. On all letters which leave my office, I use the Ph.D. after my signature. I would like to be able to make such demand of the editors of different biological journals. (e.g. *Biological Bulletin, American Journal of Physiology.*) However, it has not been possible to break through custom on this latter regard as yet.

It is my suggestion that all biologists, who are interested in raising the prestige of their profession, use their highest academic degree behind their name on every occasion possible. Moreover, I recommend that the AIBS and the member and affiliate societies do all that is possible to further this custom. Admittedly this is a small matter but I feel that it is important to the welfare of biology as a whole. If some of our membership feel that such designation smacks of immodesty, I suggest that they suffer this embarrassment for the good of the profession as a whole. Now is the time when we should put aside personal preferences and desires in order to advance the welfare of biology as an honorable profession. The time is critical and every effort must be made to raise the status of the biological profession to a level equalling that of the chemists, physicists, and medicine men.

Charles G. Wilber, Ph.D., Chief, Comparative Physiology Branch, U.S. Army Chemical Warfare Laboratories

Biology Library

One copy of each publication submitted for listing should be sent to the Editor, AIBS Bulletin, American Institute of Biological Sciences, 2000 P Street, N.W., Washington 6, D.C. Only books published within a year of receipt will be reviewed. Books marked with an ★ are those published by Bulletin advertisers.

ANIMAL SCIENCES

Insect Migration C. B. WILLIAMS. Macmillan Book Company, New York, 235 pgs., 11 color plates; 22 photographs; 49 maps and diagrams, (1958) $6.00.

In this most recent addition to a long list of *New Naturalist* books published in Great Britain, the author presents ample proof that, as do many other animal groups, many insect species show purposeful migration tendencies, with evidence of return to origin in some instances. Though shown to be manifested primarily in butterflies, moths and dragonflies, the book is replete with evidence showing such tendencies in species representing most recognized Orders. In addition to the use of marked specimens the author reports that body-fat content is a fairly accurate index of flight distance. The author comments that aside from crop damage, mass movement of insects may be responsible for carrying animal parasites into new areas in sufficient numbers to be of economic importance, particularly in the case of poultry.

While the author's residence in England serves as a pivotal point for his observations, his broad travels and exhaustive search of literature covers a wide range of foreign countries in both hemispheres. He thus brings together previously sparse and widely scattered published observations in this field. He includes a carefully selected bibliography of 65 references dating from 1200 B.C. to 1958 A.D., each accompanied by an informative abstract. The Appendix carries a most interesting Table showing the number of individuals of 29 species of immigrant butterflies and moths reaching Great Britain from the Continent, annually, from 1850 to 1955.

The author, former Head of the Department of Entomology, Rothamsted Experiment Station, Harpenden, England, is well qualified to present this subject, having made it a lifelong study with ample opportunity to confirm his own observations on a world-wide basis. Its reading is recommended to both the layman as well as to all entomologists. *H. M. Armitage, 1617 41st St., Sacramento 19, Calif.*

Extinct and Vanishing Birds of the World. JAMES C. GREENWAY, JR. 518 pgs., illus. Special Publication No. 13, American Committee for International

Wild Life Protection, New York, New York. (May be ordered from above committee, New York Zoological Park, New York 60, New York). (1958) $5.00

The man who reads this volume must feel a sense of remorse and of sadness. Whether or not man directly or indirectly has made these lists so long is not well established but the finger of fate points directly at him, especially the European of the last three centuries who occupied the North American continent and swept over the islands in the seas. In these two areas, especially on islands, have occurred most extinction and decimation of species. The extinct species (probably extinct species and rare species) are summarized in introductory lists.

A hypothetical list is given of those birds known only from pictures and descriptions of early travelers. A section of major interest covers the geography of extinction with an historical basis. The most descriptive and largest section includes in systematic order accounts of extinct or vanishing forms. The urgency of the need for increasing our knowledge of the biology and ecology of the vanishing species is obvious here. For many species the museum systematist-curator does not know in which specimen case the bits and pieces of the last remains of a species belong. In an appendix there are listed the museums of the world in which rest these last remains. A bibliography of more than 1000 references and a thorough index complete this masterful compilation of information on a substantial part of one of our most intriguing animals—a part that seems fast slipping away. *Dwain W. Warner, University of Minnesota.*

A Field Guide to Reptiles and Amphibians of Eastern North America. ROGER CONANT, with illustrations by Isabelle Hunt Conant, 366 pgs., 1100 illus., 405 in color. Houghton Mifflin Company, 2 Park St., Boston, Mass. (1958) $3.95.

This latest addition to the Peterson "Field Guide" series provides a guide for the identification of species and subpieces of reptiles and amphibians that occur east of the 100th meridian. Identification marks and ranges are given for each form listed, and for most there is a brief reference to ecology and life history. The problem of presenting subspecies to an audience of amateurs is handled in a novel way by illustrating and giving separate headings to well-marked subspecies and putting poorly marked ones under subheads and omitting them from the illustrations. The introduction includes a well-written statement of the subspecies problem. The introductory chapters treat briefly the capture, transportation and care in captivity of living herptiles and include a short discussion of the treatment of poisonous snake bites.

This guide is written for the amateur naturalist who will look first "at the pictures" in attempting an identification. The superbly done illustrations by Isabelle Conant, the colors of which have suffered only moderately in reproduction, make this an entirely feasible approach, which is admirably supplemented by the identification marks listed in the text along with comparisons with similar species. Sixty-two line drawings showing details of scutellation, pattern and morphological details provide additional assistance.

We doubt that the production of any other field guide has ever involved the painstaking checking and rechecking of details of structure, pattern, habit and distribution that has gone into this one. The more than two pages of acknowledgements of assistance from professional colleagues attest to the highly successful effort to achieve accuracy and up-to-datedness.

While written primarily for the amateur herpetologist, this book will be invaluable for professionals as well because of the range maps. These are the most accurate distribution maps ever published for the herptiles of eastern North America. *W. Frank Blair, University of Texas.*

Angler's Guide to the Salt Water Game Fishes Atlantic and Pacific. E. C. MIGDALSKI. 506 pgs., illus. The Ronald Press Co. (1958) $7.50

Although this book is primarily designed to give authoritative information about fishes to salt water anglers, it should be of some interest to ichthyologists. It enables the angler to identify the various species of salt water fishes commonly caught in both the Atlantic and the Pacific. Forty pages of outline drawings aid in the identification of over 150 fishes. The book includes much information on habits and distribution and contains numerous hints on the use of lures and methods of fishing. Record weights are given for the more popular game species. It is written in a non-technical style making it quite attractive to any intelligent fisherman. In the attempt to simplify the terminology, several terms are used loosely. The book is profusely illustrated with plates of fishes and fishermen, but, unfortunately, there is little attempt to space the plates with the text material. It is a book which can be read for pleasure and is a desirable reference work for anyone interested in salt water fishes. *Samuel Eddy, University of Minnesota.*

Foundations of Embryology. BRADLEY M. PATTEN. 578 pgs., illus. McGraw-Hill Book Co., New York. (1958) $10.50.

In this volume Patten has brought under one cover the essential features of his three earlier books on the embryology of the chick, pig and human. The book is designed for a first course in embryology and as a foundation for students who are to continue with either medical, comparative or experimental embryology. Most of the features responsible for the success of the earlier books have been incorporated into this one. Treatment of avian and mammalian development in a manner which stresses similarities (plus comparison with early morphogenesis in amphibian embryos and amphioxus) represents a distinct improvement over the previous management of the material in separate books. The treatment of later organogenesis goes beyond that found in most elementary texts and includes a brief account of function for some structures.

Experimental contributions to an understanding of developmental mechanics have been included in the discussion of gastrulation and germ layer formation. They are briefly mentioned in other areas (such as neural plate and lens induction) but are not greatly stressed. Patten has been cautious not to fix the names of ectoderm, mesoderm and endoderm to the germ layers until they have reached a reasonably definitive position, but he does not carry this caution far enough. Curiously, his well known chart of the derivatives of the three primary germ layers is repeated without revision. This is not up to date in at least one place: neural crest is now known to contribute extensively to the chondrocranium and visceral skeleton in amphibia and most likely does so in birds and mammals as well. This is not indicated. In view of his contributions in this field I am surprised that Patten has refrained from any discussion of teratology, though this was probably omitted in an attempt to keep the discussion to foundation material.

How well this book will serve beginning embryology courses depends on what is considered to be the best introduction for a beginning student. An increasing number of embryologists believe that principles of development, rather than description of developmental events, should be stressed. They would like a text which emphasizes such matters as morphogenetic movements, tissue interactions, growth phenomena, developmental genetics, etc. Enough descriptive material is desired to orient the student and provide an understanding of the material used to illustrate these principles. However, many embryologists still subscribe, along with Patten, to the notion that the foundation should consist mostly of description. Patten's book is definitely weak for the people who emphasize principles, but makes an excellent adjunct for the laboratory material still used in many of their courses.

In general the references for collateral reading are inclusive and should provide adequate source material. The format of the book is excellent; the type is clear and readable and the illustrations are truly illustrative and well chosen. In my opinion the book is probably the best of those which emphasize description. *Edgar Zwilling, Connecticut Agricultural Experiment Station, Storrs.*

General Zoology. GAIRDNER B. MOMENT. 632 pgs., illus. Houghton Mifflin Co., Cambridge, Massachusetts. (1958) $7.50.

The author has produced a fine introductory textbook which should serve to stimulate interest of students starting the

study of zoology. The book is divided into six parts. Part I, consisting of three chapters, introduces the student to basic structural and physiological concepts underlying biological phenomena. Part II consists of four chapters which deals systematically with the primitive phyla from Protozoa through Ctenophora. In Part III, before consideration of the higher phyla, the author takes up Genetics, Development, and Evolution. This serves in a rather interesting way to prepare the student for a discussion of the more advanced groups and for an introduction to the principles best seen in these groups. Part IV again takes up the phyletic review, covering the protostome branch of the animal kingdom, flat worms through the arthropods. Part V covers the deuterostome branch, concluding with a discussion of mammals. In the latter chapters of Part V the emphasis merges into a consideration of the physiology of cells and of organ systems, of energetics, and homeostasis. In this manner the correlation between these systematic groups and the physiological processes they demonstrate is brought out. The final two chapters, Part VI, discuss the interaction between the organism and its environment. Ecological levels of organization are detailed. Group and population interactions are considered, as are the newer phases of study of animal behavior.

The discussion of each phylum culminates in a consideration of the evolutionary relationships within that group and with the rest of the animal kingdom. Simplification is sometimes accompanied by dogmatic assertions, objectionable to the advanced student as, for example, "tapeworms are clearly derived from digenetic trematodes." However, a discussion of Hadzi's view on the origin of the metazoans is included. There is an excellent clarity of presentation, emphasizing the type of evidence leading to conclusions on basic animal relationships. This is the first time, in the reviewer's opinion, that the classic Haeckaelian views have been challenged in an introductory zoology textbook. The usual gap between the appearance of a new concept in research papers and in a textbook has been closed in this book! It may on occasion lead to hasty conclusions, but is in general, a refreshing and commendable addition.

The book is rich in material on the development of scientific ideas and the experimental method. Carefully selected review questions and significant references, classical and recent, are found at the end of each chapter. A brief glossary of biological terms is also included. The book is well illustrated both with line drawings and selected photographs which are of high quality and clarity.

This textbook should receive serious considerations by those who are selecting a text for a general treatment of the fundamental aspects of animal biology, emphasizing both phyletic relationships and the basic principles which challenge the beginning student. *Richard A. Booloottian, University of California at Los Angeles.*

Embryos and Ancestors. SIR GAVIN DEBEER. 197 pgs., illus. Oxford University Press, New York. (3rd edition, 1958) $4.00

The bards of Madison Avenue might well pay homage to Haeckel as their patron saint, for his jingle ontogeny recapitulates phylogeny has "established its hold over the minds of zoologists, even subconsciously,—" (pg. 164). This hold is hard to break because it is not devoid of truth. The limits of this truth need constant reiteration.

Sir Gavin uses this Centenary Celebration of the Theory of Evolution to again reiterate the relationships between embryology and evolution, and to again draw attention to the disservice done to science by allowing its concepts to freeze. This volume maintains its previous format and, with the exception of a single figure, the illustrations are the same. Revisions and additions have been evenly distributed throughout, with the exception of the chapter on Neotony which has been nearly doubled in length. The 3 new pages of bibliography include references as recent as 1957.

The major portion of the book is devoted to the relationship between ontogeny and phylogeny and is illustrated by many specific examples. The chapters added in 1951 on taxonomy, homology, and the germ layers remain little changed.

To the professional in the fields of embryology and evolution Sir Gavin may seem to be jousting with a straw man and, of course, dealing as he does with concepts, objectionable passages can be found. However, the naiveté of the new graduate student, the extent to which outmoded concepts appear in elementary textbooks of general zoology and even embryology, and the absence of reference to these matters in many standard texts on evolution indicate the value of a re-edition of this book. The arguments have been sharpened and the examples made more cogent, drawing as they do on the older literature viewed in the light of recent information. Thus, the reading of this book brings the sparkle of new knowledge to the mellowness of recalled knowledge.

The teaching of undergraduate embryology has, to a great extent, constituted a service function for pre-med training. Many are the students who complete Embryology without learning of its broader implications. If the re-edition of this book leads to the reintroduction of several lectures with broader outlook, it will have served a useful purpose.

The extensive current interest in casual embryology has led to the development of a group of embryologists less at home with these classical questions of embryology than with chemistry, physics, or the other tools of their trade. Sir Gavin addresses this in his conclusions and is explicit in his discussion of why Haeckel's concepts retarded our progress in the analysis of development. Although many of these matters are treated elsewhere, there are not many places where the problems of the relationships of ontogeny to phylogeny, of embryology to taxonomy and the analysis of homologies, and of the true meaning of the words "germ layers" are as readably treated as they have been by Sir Gavin. *George W. Nace, University of Michigan.*

Anatomy of the Chordates. CHARLES K. WEICHERT. 899 pgs., illus. McGraw-Hill, New York, (2nd edition, 1958) $9.50

Part 1 and 2 of Weichert's revised edition reviews the Chordates and treats of the organ systems. The discussions of these are followed in a sequential manner, although the discussion of each organ system does not presuppose a knowledge of earlier chapters. Part 3 details the anatomy of the lamprey, dogfish, Necturus and the cat. The discussion of each is designed to serve both as a reference text and a laboratory manual. With some help from the instructor, these accounts should suffice for the student. A summary account of characteristics and advances appear in Chapter 19 duplicates, in part, classification as set forth in Chapter 2. While a suitable index has been prepared, the omission of a glossary is unfortunate.

Professor Weichert has added many new illustrations to his revised edition. Greater emphasis has been placed on classification, in keeping with the increased interest in systematic zoology. There is, however, a certain unbalance in this treatment, the coelacanths being accorded a full page whereas the classification of birds is afforded only two pages. The keeled sternum of moles is much more prominent than in our common bats, a fact which is overlooked on page 854. Practically no reference is made to the natural history of the chordates, inclusion of which in the first edition contributed materially to the interest of the student.

This well written volume is an excellent introduction to chordate anatomy, and should be of more than general interest as a reference work as well as a useful text. *W. J. Hamilton, Jr., Cornell University.*

Morphological Integration. EVERETT C. OLSON and ROBERT L. MILLER. The University of Chicago Press, Chicago, Ill. 317 pgs. (1958) $10.

Ever since studies of morphology were first undertaken, the importance of correlating the structural parts of an individual organism has been recognized. Until now, however, little has been done to develop the concept of the organism as an integrated structural-functional unit through the use of biometric techniques.

The phrase, "morphological integration", as used by the authors means the summation of the totality of characters which, in their interdependency of form, produces an organism. The basic hypothesis which is presented and tested by the studies described in this book may be outlined in approximately the words of the authors as follows: "since an organism is

or has been a living entity, the study of morphological integration is concerned with the dynamic (functional) as well as the static attributes of life. Each component of the organism must be formed during its development in such a way that the part it plays in the existence and functions of the whole is carried out properly in relation to all other parts." And, finally, it appears logical to the authors that the degree of interdependency of any two or more components in development and function would be directly related to the extent of their particular morphological integration as expressed by the association of measures taken on these components. For reasons which cannot be detailed here the authors have chosen the coefficient of correlation as the means for expressing association between body parts.

The first two chapters present in verbal, non-technical language, an account of the basic concepts and a summary statement of the position that morphological integration may come to occupy in the field of organic evolution. It is in the field of paleozoology that the primary interests of the authors lie. The next five chapters deal with the formal and technical aspects of the theoretical framework on which the work is based. The final two chapters are concerned with morphological integration and evolution and include empirical studies and some theoretical extrapolations beyond the data from measurements and calculations.

Readers in the fields of genetics, developmental biology, evolution and paleontology will find this book unusually provocative. As the authors put it in their final sentence, "once the concept of covariance has become an integral part of the thought process, the interpretations that have been presented will fall into place beside more usual interpretations and lose what may appear at first sight to be an antagonistic position." *Nelson T. Spratt, Jr., University of Minnesota.*

Insect Flight. J. W. S. PRINGLE. 132 pgs. Cambridge Monographs in Experimental Biology No. 9. Cambridge University Press, New York. (1957) $3.00

From the earliest times man has wondered at the powers of flight of birds and, perhaps to a much lesser extent, of insects. The Assyrians endowed their chief god, Asshur, with wings; the Greeks pictured Hermes with winged heels and helmet; the Valkyries of Norse mythology rode winged horses—counterparts of Pegasus of Greek mythology. Investigation of flight in insects has attracted the attention of biologists and other scientists during the past twenty-five years especially, although the work of Marey dates back almost a century. Working during a period of scientific technical advances especially useful to studies of insect flight, the author has condensed in this brief monograph, an excellent coverage of the known facts of insect flight which have been gleaned particularly during the past two decades.

Carefully orienting the reader, the author begins with a clear and concise exposition of the morphology of flight mechanisms, which includes clear and distinct drawings of the skeletal structures and details of the musculature involved in insect flight. This is followed by a consideration of the kinematics of wing activity during flight, especially in the Diptera, Hymenoptera, Coleoptera, Odonata, Hemiptera and Orthoptera. For the insect physiologist particularly, an excellent coverage of the recent literature of the structural details and known biochemical facts of flight muscle physiology are included. Details of the mechanical and electrical events concomitant with initiation and actual activity of nerve and muscle involved in flying are also competently handled.

Following is a brief, lucid treatment of the aerodynamics of flight in general and the still unresolved hypotheses of the dynamics of insect flight, in particular. The final chapter is an authoritative discussion of the nervous coordination and regulation of insect flight activities.

Working at a time when interest in certain aspects of this subject is especially high, Dr. Pringle pays his contemporaries in this field due courtesy in his objective treatment of their findings and impartial evaluation of their interpretations. Well-written and carefully edited, the book suffers from a number of typographical errors (including the misspelling of the names of two well-known authors), in the bibliography. As an authoritative and well-written review of the recent literature in this field, this book should prove an important reference to the biologist in general and the entomologist in particular. *Morris Fockstein, New York University College of Medicine.*

The UFAW Handbook on the Care and Management of Laboratory Animals. A. N. WORDEN and W. LANE-PETTER. 951 pgs., illus. Courier Printing & Pub. Co., Grove Hill Rd., Tunbridge Wells, Kent, England. (2nd edition, 1957) $10.00

The importance of laboratory animals has increased enormously in the past 10 years since the first edition was published. This handbook makes a noble and effective attempt to bring together the huge volume of information on production, care, and use of laboratory animals. Over 70 experts have contributed up-to-date chapters on well selected subjects. The first 16 chapters include information on housing, breeding, handling, and using various laboratory animals. The second part of the book contains separate chapters on about 50 species of the more commonly used laboratory animals plus notes on other species. The species of animals are discussed by groups including the rodents and lagomorphs, insectivores, carnivores, ungulates, primates, marsupials, birds, reptiles, amphibia, fish, and invertebrates.

The objective of this book published by the Universities Federation for Animal Welfare is to promote humane care of laboratory animals. It is pointed out that both from humanitarian and technical points of view laboratory animals should be provided with the best care and conditions that are practical before and during experimental work. The effective presentation of technical and practical information on laboratory animal care and use in this handbook should accomplish this aim and improve experimentation. Animal breeders and research investigators will find this book indispensable as a readily available reference and source of practical information. *Dale W. Jenkins, Institute of Laboratory Animal Resources, National Research Council, Washington, D. C.*

Essentials of Human Anatomy. RUSSELL T. WOODBURNE. 620 pgs., illus. Oxford University Press, New York. (1957)

This book has been written to attempt to satisfy the need for a presentation of anatomical knowledge in a more concise manner than is done by the large and classic textbooks of anatomy. The author has stressed that it is not to be considered as an elementary text, that "in some respects its detail goes beyond that of the currently used textbooks." The attempt has been made to arrive at brevity through stressing essentials and functional aspects of the subject, as well as by limiting the discussion of variations to only those which are most frequent and of most practical importance.

An important feature of the work is its adherence to the anatomical nomenclature adopted by the Sixth International Congress of Anatomists, meeting in Paris in 1955. The changes introduced by this revision are considered by the author to be simple, consistent and logical. Eponyms have been eliminated and the older terms are not carried with the newer ones, even in the bracketed form.

The book is divided into two major portions, the first dealing with general concepts in anatomy. Here each of the systems is presented for consideration by the student. Stress is given to the fundamental features of the gross structure and to as much of the microscopic structure of the various parts of these systems as is necessary for an understanding of the way in which they function.

The second and much longer portion of the book deals with the various regions of the body. Within the discussion of each region, the order of presentation is from superficial to deep structures, the natural order in dissection.

It is not quite correct to speak of the approach in the second section of the book as being simply a regional one, since the author has made a very definite effort to relate the parts within the individual region to the rest of the system. Repeated stress is placed on the continuity of the parts of the blood, vascular, the nervous, and other systems, partly by means of illustrations that are of a synoptic character and also by means of numerous cross references within the text.

The illustrations in "Essentials of Anatomy" are refreshingly new in the great majority of cases. Three hundred and eighty six out of the 403 are presented here for the first time. The concepts in these figures, as well as their design and execution, may be spoken of as novel in many instances. For instance, the figure which illustrates the planes of the body and the terms of direction and orientation, so important for the beginning student of anatomy and yet so often a difficult hurdle for him, presents a human body within a cylinder and the planes of section and directions of orientation are cleverly brought out by use of this device.

It is our opinion that users of this book or those who wish to recommend it to the beginning medical student might well do so with an understanding that it will serve to present to such a student all, or almost all, of the detail which he will need in his course in gross anatomy, and that it should not, as have some other books which have attempted to be more concise and perhaps more readily understood than the classic text, serve simply as a supplement to such a text. "Essentials of Anatomy" is an excellent work and for many will prove the answer to the problem which confronts them: presenting in a reduced period of time the immense complexity of the structure of the human body. *Warren Andrew, University of Indiana School of Medicine*

PLANT SCIENCES

Plant Breeding and Cytogenetics. FRED C. ELLIOTT. 395 pgs. McGraw-Hill Book Company, Inc., New York (1958) $8.50

Although this book was written primarily for students of plant breeding, the author has done such an excellent job of discussing many aspects of the biology of economically important plants that the general botanist and biologist will find here a great deal of interest and value in thinking about plants as they actually grow in the garden, field, or orchard. The reader's competence in genetics and cytogenetics is assumed. So also is his knowledge of general plant anatomy, physiology and pathology. On this foundation the author builds his discussion of such breeding generalizations as can be made safely on present knowledge. He squarely faces gaps in fundamental information which make it necessary to proceed empirically until more is learned about such basic phenomena as gene action, host-pathogen interaction, plant-environment responses. The breadth and depth of the author's reading is apparent in the text and in the selected bibliographies at the ends of chapters. More important is his thoughtful evaluation of the significance of both the earlier and the very recent work of breeders and thinkers about breeding. The last three chapters on how improved varieties of plants are tested, released and controlled and on how plant breeding is organized in the United States, Canada, and Europe are of as much interest to the general or economic botanist as they are to the plant breeder, for they make clear the magnitude and complexity of the operation of improving the quality and the quantity of plant products today. Plant scientists will gain from this book an understanding, and an appreciation of the current status of one large part of their field of interest. *Harriet B. Creighton, Wellesley College*

★An Introduction to the Plant Kingdom. NORMAN H. RUSSELL. 353 pgs., illus. C. V. Mosby Co., St. Louis, Mo. (1958) $5.50

Prof. Russell has attempted to provide a text for "those who teach and the students who pursue one-semester botany courses in which the 'plant kingdom' approach is followed". The text shows failings which a first printing of most texts do, i.e. inconsistent spellings (*Marsilea* on pg. 237 and *Marsilia* on pg. 238); some ill-chosen illustrative material (use of *Cladonia* to represent a foliose lichen); terms used in illustrations not to be found in the glossary or index (suspensor, enation), nor in the glossary, index nor text (tunica, corpus); unintentional errors (inclusion of wintergreen as a Labiate); ambiguous statements (use of *Cornus* inflorescences to represent heads—in illustrating the Compositae); and omission of some common terms (perianth).

The usual errors of a general botany text are with us (production of a sporangium from the emergent hypha of a *Rhizopus* zygospore, and the use of the class Lichenes). On the other hand, the lily embryo sac is discussed quite apart from the "typical" angiosperm, instead of being amalgamated with it. There is also a good summary of angiosperm anatomy at the beginning of the study of the flowering plants; this summary can prove of value in integrating a first-quarter course with a survey of the plant kingdom in the second term, as well as introducing anatomy in the terminal botany course. The inclusion of more than the usual genera studied is refreshing (*Sarcoscypha, Plasmopara, Andraea* to mention a few). Proper emphasis is given to fossil plants as an introduction to each group of contemporary plants. The valuable chapter on ecology of the algae is followed by sections of succeeding chapters on an ecological treatment of higher groups.

The illustrations are wholly deficient. Most drawings suffer from inadequate labeling. Whereas the text describes five structures in the archegoniophore of *Marchantia*, none is labeled in the drawing. The grass flower might have been omitted for it is devoid of any labels whatever. The fairy ring pictured on pg. 146 is not convincing.

If there will be sufficient demand for a book of this subject matter, and if the illustrations are revised, this book may be of real value in teaching botany. *William T. Gillis, Michigan State University.*

Handbook of the Rubi of Great Britain and Ireland. W. C. R. WATSON. 274 pgs. Cambridge University Press, New York. (1958) $12.00

British botany, particularly topographical botany, owes much to the amateur, and until the present century the background of the amateur differed little from that of the professional. Now, with the development of cytology, genetics, palynology and other esoteric occupations for the specialist, the organization of inter-institutional exchanges of herbarium material and the printing of vast quantities of literature in journals of limited circulation, the amateur is placed at a great disadvantage. At the same time, the primary survey work has largely been completed and it is the critical groups which demand closer attention. Nevertheless, courageous amateurs could (and probably can) be found who would tackle them.

Thus, H. W. Pugsley ignored (or was ignorant of) the significance of apomixis in *Hieracium* and produced his immense *Prodromus of the British Hieracia* in 1948 claiming 260 hawkweeds for the otherwise depauperate British flora. His tremendous effort, admirable in its devotion to detail, dealt with "species" which are simply not comparable with those represented by sexually reproducing plants. The result is that the *Prodromus* is seldom consulted.

Mr. W. C. R. Watson, who gave the greatest part of his private life to the study of *Rubus*, was clearly mindful of the fate of the *Prodromus* when he produced the present book. Consequently, he devoted a large part of the introduction to an attempted refutation of the idea that blackberries reproduce apomictically in nature. Unfortunately, with its limited cytogenetic background, his exposition is quite unconvincing.

However, Mr. Watson studied the taxonomic literature in great detail; he observed his plants in the field all over the British Isles and he grew over 300 forms in his garden during a period of 40 years. With *this* experience, translated into a manuscript with loving care (and with the assistance of two very capable artists), he has undoubtedly achieved the first of his three objectives—to furnish the means of identifying any British *Rubus* (and he beats Pugsley easily by claiming that 353 "species" exist, of which 91 are endemic). It is most unlikely that his work will lie unused. His second and third objectives were to provide a means of understanding the causes and types of variation in the genus and to measure the probable relationships of the species. Success in these endeavors will require more than an inspection of the gross morphology of the plants. *H. G. Baker, University of California, Berkeley.*

★Introductory Horticulture. E. P. CHRISTOPHER. 482 pgs., illus. McGraw-Hill Book Company, Inc. New York. (1958) $7.50.

The practical horticulture part of this book, which is the most of it, is the usual

discussion of the usual topics, with the usual types of questions at the end of each chapter and a few selected references with no indication of which ones are particularly pertinent to specific parts of the chapter. The treatment seems to be no better, or no worse, and not very different from any other such texts. The adjective "introductory" in the title cannot mean that there is to be an "advanced" textbook to follow this one and so, presumably, it means that this book contains a good introduction to horticulture. This would have to be a clear and accurate description of basic plant physiology, anatomy, and morphology. Such is not the case. Chapter 2, about 40 pages in length, is a cursory coverage of "Classification, Structure and Growth of Plants." It is not precisely written, saying exactly what is meant and simultaneously eliminating what is not meant. Unless the reader has had a good, in fact a very good, course in general botany he would, in some cases get little understanding of what is going on in a plant, and in too many cases, he would get the wrong idea. There are too many errors of omission and commission. As an example of omission in the section of the chapter on "Vegetative Growth versus Flower Production" there is no mention of photoperiodism. In the section on "Tropisms, or Polarity" (an error of commission since the two words are not synonymous) there is the only general description of hormones, and in it the one naturally occurring one, indole acetic acid, about which the most is known, is not mentioned. Auxin is said to be "not a simple material" though what is meant is that several substances are called auxins. The gibberellins, about which so much has been written in the last two or three years are not mentioned. Certainly a few words should have been said about the horticultural status of these highly advertised compounds. The hope stated in the preface that this book would be a satisfactory text for a beginning course in horticulture which may have been preceded by as little as one semester of botany, and that it will be "a source of information for gardeners who want to know some of the scientific background for various horticultural practices" is I think a forlorn one. The author, and the publisher, should decide either to start from the beginning and describe accurately the fundamentals of plant science on which horticultural practices are based, making clear where necessary that we cannot yet explain why some procedures work, or to start on the assumption that the reader knows physiology and plant morphology and now wants to know how to apply his knowledge to the growing of horticulturally important plants. *Harriet B. Creighton, Wellesley College.*

MISCELLANEOUS

The Chemical Kinetics of Enzyme Action. KEITH J. LAIDLER. 419 pgs. Oxford University Press, London and New York. (1958) 60s.

Professor Laidler has achieved the difficult task of discussing the somewhat abstruse subjects of enzyme kinetics and mechanisms in a clear and readily understood fashion. This presentation is admirably suited to biologists interested in enzyme mechanisms. The first eight chapters deal with general principles such as rate laws in enzyme kinetics, the influence of pH, pressure, temperature, and concentration on enzyme reactions, and some deductions about enzyme mechanisms. The four succeeding chapters deal with specific enzyme systems, especially the hydrolytic enzymes. Chapter 13 discusses the denaturation of proteins and relates the inactivation of enzymes to this process. A brief concluding chapter summarizes the main conclusions presented in the book. An appendix presents some notes on important papers that appeared after the manuscript had been completed. The topics discussed are developed with exceptional clarity and logic, and this book will be very useful to students and research workers in this field. Dr. Laidler is Professor of Chemistry at the University of Ottawa and is also the author of "The Chemical Kinetics of Excited States." *Claude A. Villee, Harvard Medical School.*

Variables Related to Human Breast Cancer. V. ELVING ANDERSON, HAROLD O. GOODMAN and SHELDON C. REED. 172 pages, illus. University of Minnesota Press (1958) $4.00.

The variable of primary interest to the authors of this painstaking study is the genetic variable. This is natural, since all three are geneticists.

They were well aware that previous studies had demonstrated that no simple or readily analysable pattern of inheritance was involved in the determination of susceptibility to breast cancer. In the light of this knowledge the best they could hope to do was to establish that genetic factors are involved. Anderson, Goodman, and Reed knew, as do all geneticists, that to do this they would have to show an *increased familial incidence in the absence of environmental factors which could account for this increase.* The authors were conscious of the difficulties confronting them for they state in their preface that, "This was a courageous venture because it was clear from the outset that the analysis of the data would be extremely difficult, and the chances were excellent that nothing of interest would emerge from the study."

Study was based upon two sets of probands and a set of controls. The first set of probands (544) were women with breast cancer who had been patients of the University Tumor Clinic during the years 1945-1957. The controls for these were the female relatives of the husbands of the probands. The second set of probands was chosen to permit study of the frequency of breast cancer among the daughters of women with breast cancer. Clearly these probands had to be individuals who had had the disease a long time ago. A total of 77 probands who could be studied were gathered from among 202 patients who were listed as having breast cancer in the files of the University of Minnesota Hospitals for the years 1910-1925 or in the records of the University of Minnesota Pathology Department for the years 1910-1920.

The authors are to be congratulated for their detailed presentation of all aspects of their study. They carefully evaluated the adequacies of their cancer and of control populations; they examined in detail the relative merits of various methods of analysis; they canvassed with minute care the various environmental factors which have been suggested to possible causes of breast cancer; they compared their findings with those of other workers.

These authors conclude, as have others before them, that some genetic as well as non-genetic factors are involved in the causation of breast cancer. They conclude, also in agreement with other investigators, that the evidence suggests that, probably because of genetic reasons, daughters and sisters of women with breast cancer have a two- to three-fold greater risk of developing breast cancer than do women in general, but that they run no increased risk of developing cancer at other sites. Anderson, Goodman, and Reed suggest that such information should be given by physicians to patients asking about the familial nature of breast cancer.

This very carefully done, and painstakingly reported study, and the conclusions drawn from it raise two important problems for me. Namely, what is it that a geneticist wishes to learn when he undertakes an analysis of a poorly defined clinical entity which is known not to be due to any simple genetic pattern, and how should the findings of such studies be presented to inquiring patients.

I urge all who are interested in cancer, or in the methodology of studies of relatively frequent, but poorly defined (from the genetic viewpoint) characters, to read this monograph, for it offers much. *Arthur G. Steinberg, Western Reserve University.*

Progress in Biophysics and Biophysical Chemistry. Vol. 8. Edited by J. A. V. BUTLER, and B. KATZ. 403 pgs. Pergamon Press, New York. (1958.)

The writing is lively and coverage good, especially of European authors; but the treatment is hardly biophysical, in that little quantitative physical theory is presented. In the space available we can review only a few.

Whitfield gives a connected synthesis of recent data (mainly since 1952) on auditory anatomy, electrophysiology, stimulus patterns and a little psychophysics; criticizing current theories constructively. Apparently the graded inhibitory process is not yet recognized in the auditory system.

Brindley accepts only visual data from identical matching or explicable by physico-

chemistry. Without heteromatching and neurophysiologic evidence, the theories discussed seem archaic and inadequate; the receptors alone can hardly explain the complex phenomena of color vision.

Schmitt and Geschwind describe the axon surface, opening new vistas on nerve function and deserving wide attention.

Shooter assembles clearly our present knowledge of DNA: its structure, shape, flexibility and heterogeneity; its denaturation, dehydration and urea effect; its interaction with metals, organic cations and proteins.

Croftfield gives an outstanding roundup of protein biosynthesis, in several milieux at various levels of organization.

This volume also includes good articles on: physical biochemistry of the surface of erythrocytes and of bacteria; effect of radiation on DNA in cells, and the biosynthesis of connective tissue. *S. A. Talbot, Johns Hopkins University.*

Travels of William Bartram, Naturalist's Edition. Edited by FRANCIS HARPER, 727 pgs., illus. Yale University Press. (1958) $8.50.

William Bartram's *Travels* is a book that should be perennially available in print. Bartram did for 18th Century America something of what Francis Parkman did a century later in *The Oregon Trail*—he recorded the current scene so faithfully and yet so movingly that the reading of it is never dull, and one forgets as he reads that this is part of the history of a country. All this has been said so many times that it is superfluous to point out that a new edition of the *Travels* is always an event, both literary and biological. The special feature of the Yale edition is the relatively enormous amount of explanatory and documentary material which has been supplied by the editor. (The Introduction, Commentary, Annotated Index, list of References, list of Maps and Atlases, and a section devoted to orthography, together occupy 386 pages, as against the approximately 350 pages of the *Travels* proper). The reader for whom this *Naturalist's* Edition is intended will find it replete with information on 18th Century botany, zoology, geography and anthropology, interpreted for and made intelligible to the modern reader. It is no exaggeration to say that no other living naturalist could have done this except Francis Harper, who is unique not only in his knowledge of the Bartrams and of the Southeast, but also in his competence in so many different fields of botany and zoology, and in his ability to summarize and interpret without loss of clarity or interest. *Rogers McVaugh, University of Michigan.*

Conservation of Natural Resources. Edited by GUY-HAROLD SMITH. 474 pgs., illus. John Wiley and Sons, New York. (1958) $8.50.

This book represents a rather extensive revision of the previous edition (1950) with one new chapter and several different authors among the nineteen contributors. A chapter by Harold H. McCarty on "Economics and Conservation" has been added, whereas that entitled "Tree Crops" in the earlier edition has been deleted, although a brief paragraph on this subject has been included in another section. Chapters dealing with the reclamation of wet and overflow lands, irrigation, mineral resources, conservation of man and state and local planning have been entirely rewritten. References to pertinent literature at the conclusion of each chapter have been brought up-to-date, and miscellaneous changes in the revision of other sections have been made. For example, pages dealing with a history of lumbering in the earlier edition have been deleted (pgs. 198-199, ed. 1). The net effect of revision, aside from reducing the overall length by seventy-eight pages has been to add more up-to-date material, to strengthen the high quality of the illustrations and to make for a more useful and attractive volume. *W. B. Drew, Michigan State University.*

Trends in Genetic Analysis. C. PONTECORVO. 145 pgs., illus. Columbia University Press, New York (1958) $4.00.

This remarkable book is based on the Jesup Lectures which Dr. Pontecorvo delivered at Columbia University in April, 1956. The published manuscript, however, has been brought up to date and revised to include discussion of material published in 1957 and 1958.

Dr. Pontecorvo's theme is the nature of the gene (cistron). He discusses this brilliantly in six chapters entitled Genetic Analysis and Its Resolving Power, Allelism, Structure and Function of the Genetic Material, Recombination, Mapping Chromosomes via Mitotic Recombination, and Novel Genetic Systems.

It is safe to predict that this book will become a milestone, marking the end of the era introduced by Morgan's fine summary of the gene, published in 1919 under the title *The Physical Basis of Heredity*. Like Morgan's book it will be a classic in the field.

Pontecorvo emphasizes that the gene is divisible, by mutation as well as by recombination. He revives, in modern terms, Goldschmidt's suggestion that the gene (cistron) may not always involve the same physical units. But differently, identical nucleotide pairs may sometimes function as part of one cistron and other times as part of another. Pontecorvo offers estimates of the number of mutational sites per cistron, and of the number of nucleotide pairs per cistron and per unit of recombination. Estimates of the minimal number of mutational sites per cistron run from as low as 2 to 3 to as high as 1800 depending upon the cistron, the organism, and the method of estimation. Estimates of the number of nucleotide pairs per minimal unit of recombination run from 2 in Phage T4 to 500,000 in the mouse.

We seem well on our way toward a chemical picture of the gene. We are not so far advanced in our efforts to understand its role in morphology.

Chemists, physicists, as well as biologists will find this a stimulating and thought provoking book. *Arthur G. Steinberg, Western Reserve University.*

In Search Of Man. ANDRE MISSENARD. 346 pgs., Hawthorn Books, Inc., New York (1957) $5.95.

The author, a French engineer who worked with Alexis Carrel, provides us in this book his miscellaneous thoughts over a wide spectrum of topics. The subject of genetics occupies his attention first, and while much of it is an elementary review of the topic, quite often discredited theories are presented in a very sympathetic manner suggesting that they may be valid. For example, the idea that the initial sexual contact of the female leaves indelible characteristics which subsequent contact with other males cannot erase in any future offspring is described as if it is a theory which might have validity even though the author admits experiments have disproved it.

The main theme of the book is that man's development is determined by his physical environment (climate and geography), chemical (diet and other chemicals), and psychical (education and culture). The flyer taken into the author's favorite topic of the influence of climate recalls many of the American studies on this point. The discussion on education and intelligence studies was particularly interesting to this reviewer as a continental viewpoint is described in some detail. His remarks about the French educational system should be good reading for many of our current "authorities" on what is wrong with American science education. He concludes in a Lecomte du Noüy fashion about science and ethics. This is particularly necessary it seems as the previous material is about making man to order in our future world.

The book is a rambling discourse on a variety of topics some of which may prove to be quite stimulating as a source of ideas. But it suffers in the reviewer's mind from the impression that it is a collection of notes with only a sparse framework to hold it together. *Paul Klinge, Indiana University.*

★Principles of Field Biology and Ecology. ALLEN H. BENTON and WILLIAM E. WERNER, JR. 341 pgs., illus. McGraw-Hill Book Company, New York. (1958) $6.50

This book represents a unique summary of various biological concepts which may best be observed and studied in the field. As a text the book is intended for a course following elementary college history. (A complementing workbook is printed by the Burgess Publishing Co., Minneapolis, Minn.) The subject matter is directed to students interested in either general or preprofessional backgrounds as well as to amateurs.

The case for the application of the scientific method to the statement and solution of problems is well presented and illustrated in the introductory chapter. Following the second chapter on the history of American field biology is a very useful and important chapter on taxonomic principles. Community types and the methodology of terrestrial and freshwater field studies are the subjects of the chapter on ecological principles. The fifth and sixth chapters cover the essential concepts related to ecological succession in terrestrial and freshwater environments. Basic and applied research aspects of economic field biology are discussed in terms of selected examples. Under the heading, principles of population study (Chapter 8), population problems, sampling, distribution of population components, age and sex composition, and population behavior are discussed. A brief introduction to principles of behavior quite adequately covers modern viewpoints including Lehrmann's critique of Lorenz's instinctive behavior theory. Chapters on the use of biological literature and on the choice and conduct of field research problems conclude the test, which is followed by a brief glossary. An extensive appendix includes lists of useful books and periodicals, discussions of various types of field equipment, notes on the use of statistics, and sources of literature, supplies, equipment, and maps.

The numerous photographs fit well into the easily readable text which is remarkably free of unexplained technical terminology. Ecological concepts and procedures are almost always illustrated by practical examples. The simplification which is sometimes necessary for an elementary explanation only rarely results in possibly misleading oversimplification. Although there is broad general coverage of ecological concepts, illustrations and examples pertain frequently to biota and environments in central and northeastern United States, "dynamics" is rather briefly treated in the chapter on population study, and a consideration of marine biology is omitted. The references cited and the suggested reading references listed at the end of each chapter are well selected and up to date; they will prove invaluable to the student planning advanced field studies. The book should find a prominent place in courses intermediate to elementary biological courses and advanced ecological studies; it should be useful as a supplemental text for advanced high school biology students.
Donald E. Wohlschlag, Stanford University, California

Citadel, Market and Altar. SPENCER HEATH. 259 pp. The Science of Society Foundation, Inc., Roadsend Gardens, Elkridge, 1502 Montgomery Road, Baltimore, Md. (1957) $6.00.

The author, a retired engineer, attempts in this book to outline a theory of society and economics which exalts the free enterprise system. Briefly, the desirable society will be composed of "units" which will be basically free in their ability to produce and transform energy. Their growth and strength and span of existence will depend upon the relationships which they have with other similar units. All organizations exist primarily on these intricate, reciprocal relationships. Physics is drawn on extensively for terminology and for concepts to illustrate the theory. The biological sciences come into play by analogies with socio-economic units and cells and other basic biological units. Most of the dangers and few of the advantages seem to accrue by the extensive use of analogies which the author makes. He does have an interesting theory about population pressures and the productive potential of populations with short life span constituents. He points out that such societies waste a great deal of time in the life span of the individual in developing, reproducing, and finally dying before their productive potential is realized. Such societies, therefore, cannot exist in competition with societies of low reproductive potential, but with long productive life spans. A great many ideas are presented in the volume which may prove to be of interest to the student of society and of economics. *Paul Klinge, Indiana University.*

★The Genetic Basis of Selection. I. MICHAEL LERNER, 298 pgs. John Wiley and Sons, Inc., New York (1958) $8.00.

This is a book devoted entirely to selection. It is designed for advanced students who have a thorough knowledge of modern genetics but who may lack an extensive background in statistics. The author separates off statistical descriptions by using inserts, called boxes, thereby making the subject matter easier to read. Students who want sources for theories or formulae will find extensive citations of other workers.

The book begins with discussions of general concepts of the biological phenomenon of selection within a breeding population and referring to polygenic as well as monogenic inheritance. More attention is given to artificial than to natural selection. Heritability, genetic variance, responses to selection pressure, and bases for various selection practices in artificial selection are discussed in detail. Data used for illustration are taken from the author's research using poultry.

The author refers to considerations that poultry breeders give to the commercial importance of various selection schemes and to the use of methods other than selection. Although he recognizes the significance of selection in improvement of animals and plants, the author questions the reasoning by geneticists who want always to breed for disease resistance even though the disease might be controlled by eliminating carriers or by use of non-genetic methods for improvement. Some of the unsolved problems of selection are cited. *Clarence P. Oliver, University of Texas.*

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General Biochemistry. J. S. FRUTON and S. SIMMONDS. 1077 pgs., illus. John Wiley and Sons, Inc., New York (2nd edition, 1958).

As a text for use in an advanced survey course in biochemistry, this new edition is unquestionably outstanding. In general the organization has been designed carefully, and the writing itself is clear, if unimaginative.

In emphasis, the subject matter is strongly metabolic in vogue with current customs in biochemical thinking. The sections on the chemistry and metabolism of proteins are particularly thorough. Two broad areas of biochemistry are consequently treated only cursorily, nutrition and the purely chemical aspects of biochemistry. For example, a scant 27 pages are devoted to the chemistry of carbohydrates, and the system of carbohydrate nomenclature developed jointly by British and American workers for the American Chemical Society in 1953 is not presented. Nutrition, a major aspect of biochemistry and precursor of most metabolic investigations, is only treated in scattered sections throughout the text. Biochemical knowledge of plants and microorganisms is neither as accurately nor as extensively considered as is information on mammals.

As a whole the text is one which should serve excellently for courses in biochemistry at the senior and graduate levels. It is plainly too comprehensive to be useful in elementary courses. *Kendall W. King, Virginia Polytechnic Institute.*

Russian-English Biological and Medical Dictionary. EUGENE A. CARPOVICH. 400 pgs. Technical Dictionaries Co., Box 144, New York 31, N. Y. (1958) $12.00.

By the two main criteria for judging a bilingual science dictionary—completeness and accuracy—this book is highly satisfactory. Its 35,000 Russian entries cover the bulk of fundamental technical terms in the main fields of biology, botany, and medicine. The editorial and typographical errors are neither numerous nor serious enough to detract from its value. The chief criticism of the book is that the crowded pages and insufficiently sharp type make it somewhat uncomfortable to use over an extended period of time.

Despite this and the omissions to be expected in a pioneering work, it will serve the dictionary needs of most students, translators, librarians, indexers, and others concerned with Russian biological and botanical publications until microglossaries are available for the individual branches of science. *Sidney Glazer, Bethesda, Md.*

Getting Acquainted with Minerals. GEORGE LETCHWORTH ENGLISH and DAVID E. JENSEN. 362 pgs., illus. McGraw-Hill Book Company, New York. (1958).

An authoritative reference on the collecting and identification of precious and semi-precious minerals, this book is written in terms easily understood by the novice and is of invaluable aid to the advanced collector. One section is written especially for anyone interested in the nomenclature and formations of crystal specimens; this section can be understood by the average layman without special training. Also included is a well planned appendix showing hardness and physical properties of nearly all minerals. The photography throughout is much better than that found in most books on this subject. *H. James Stewart, Ft. Meade, Maryland.*

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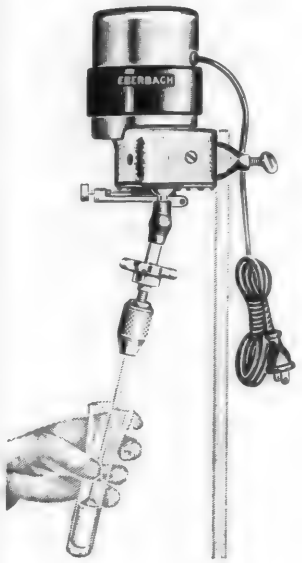

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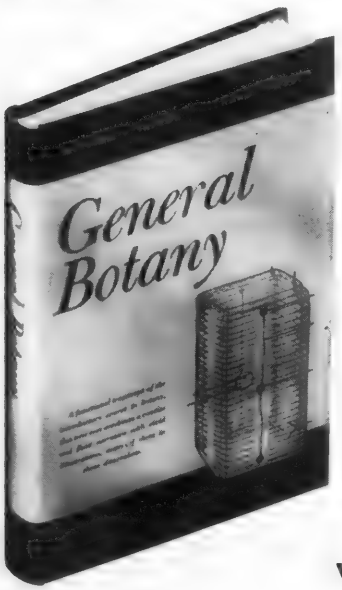

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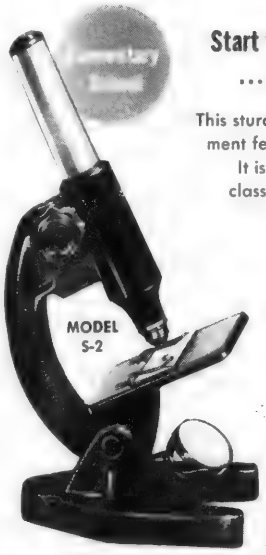

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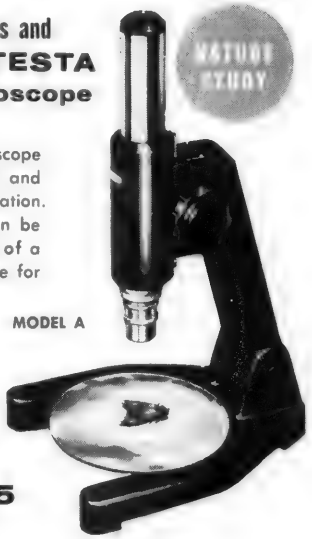

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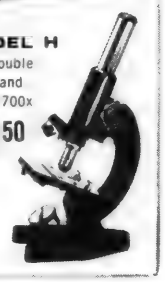

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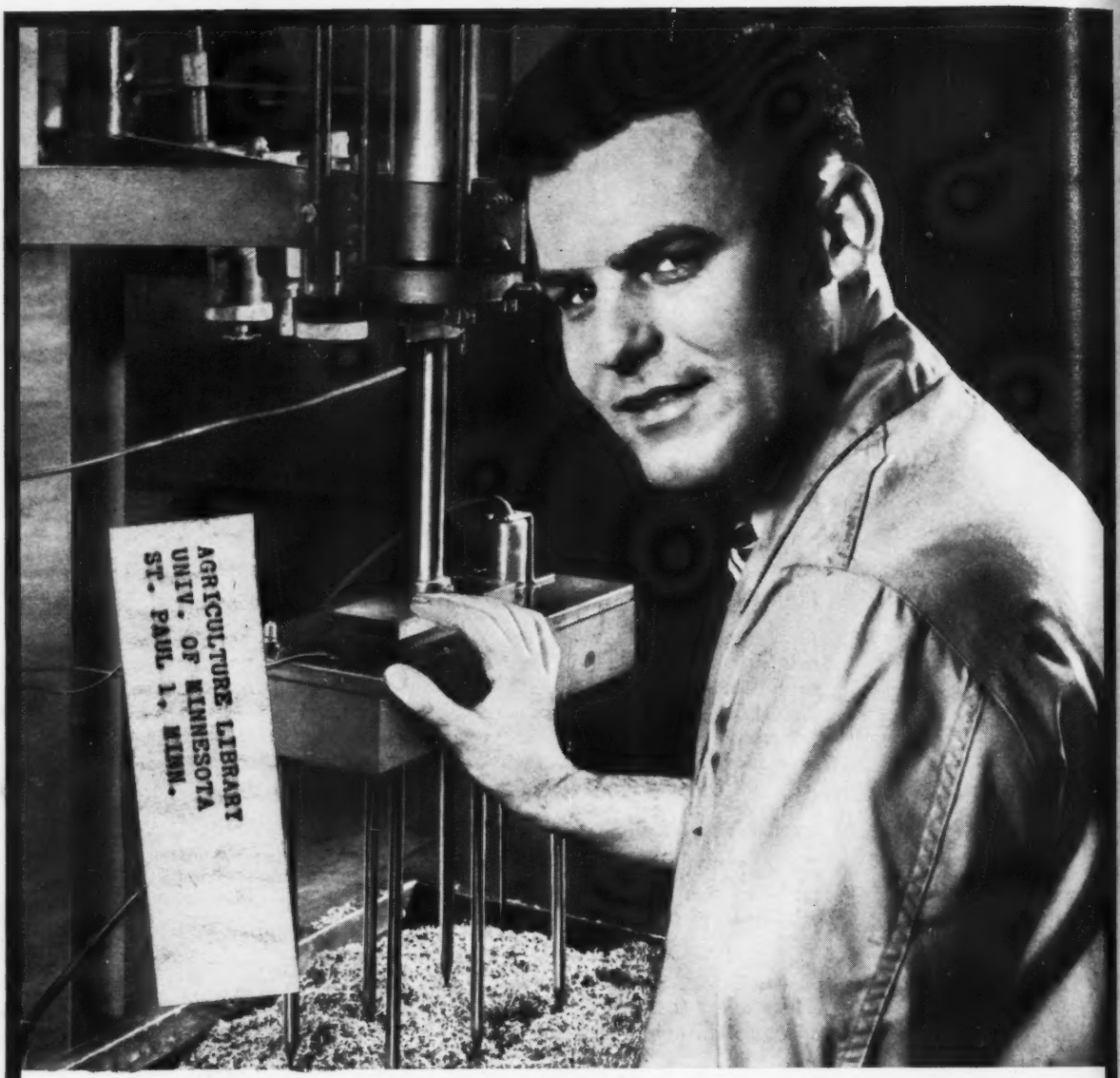

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